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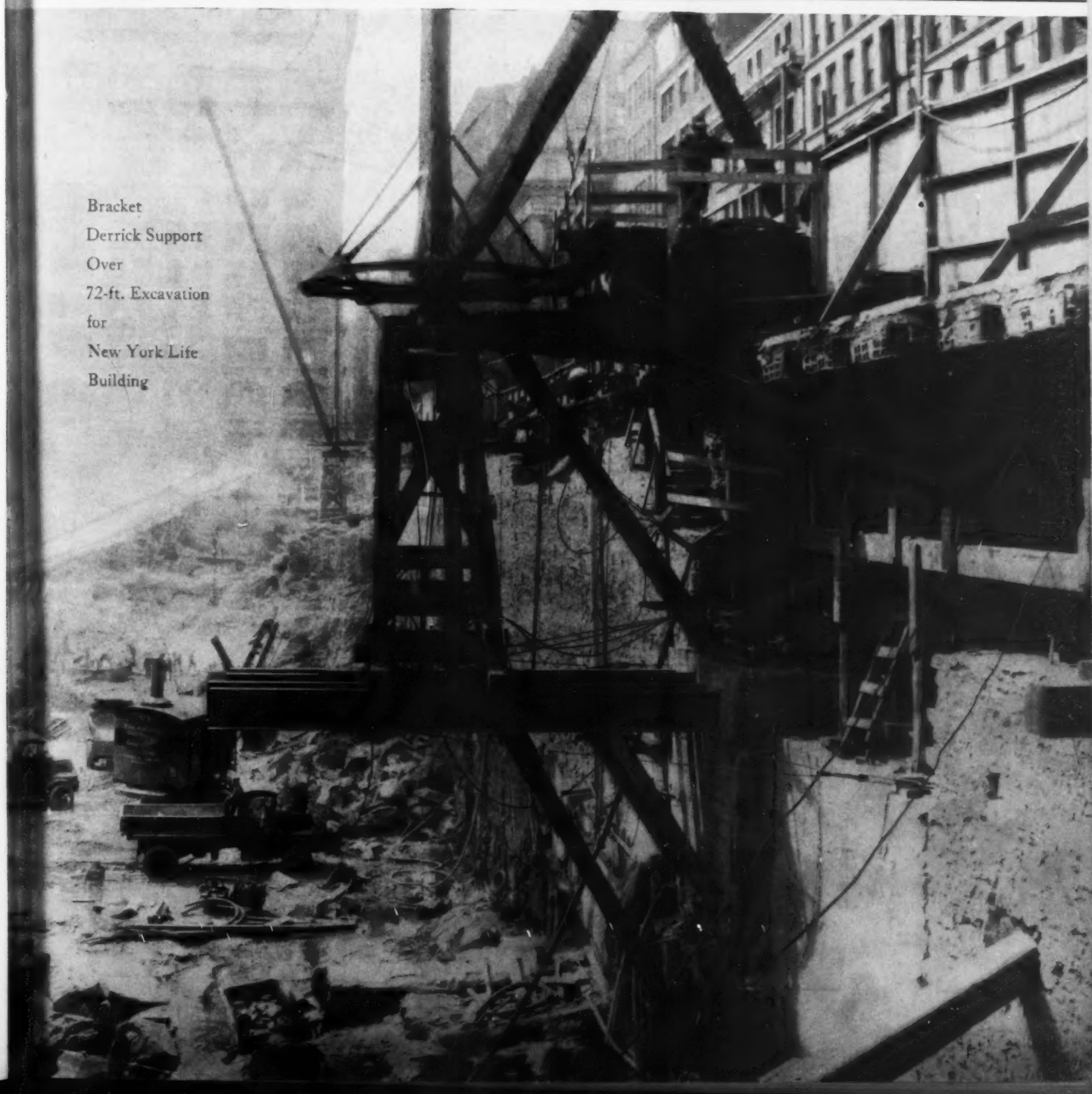

Bracket Derrick Support Over 72-ft. Excavation for New York Life Building

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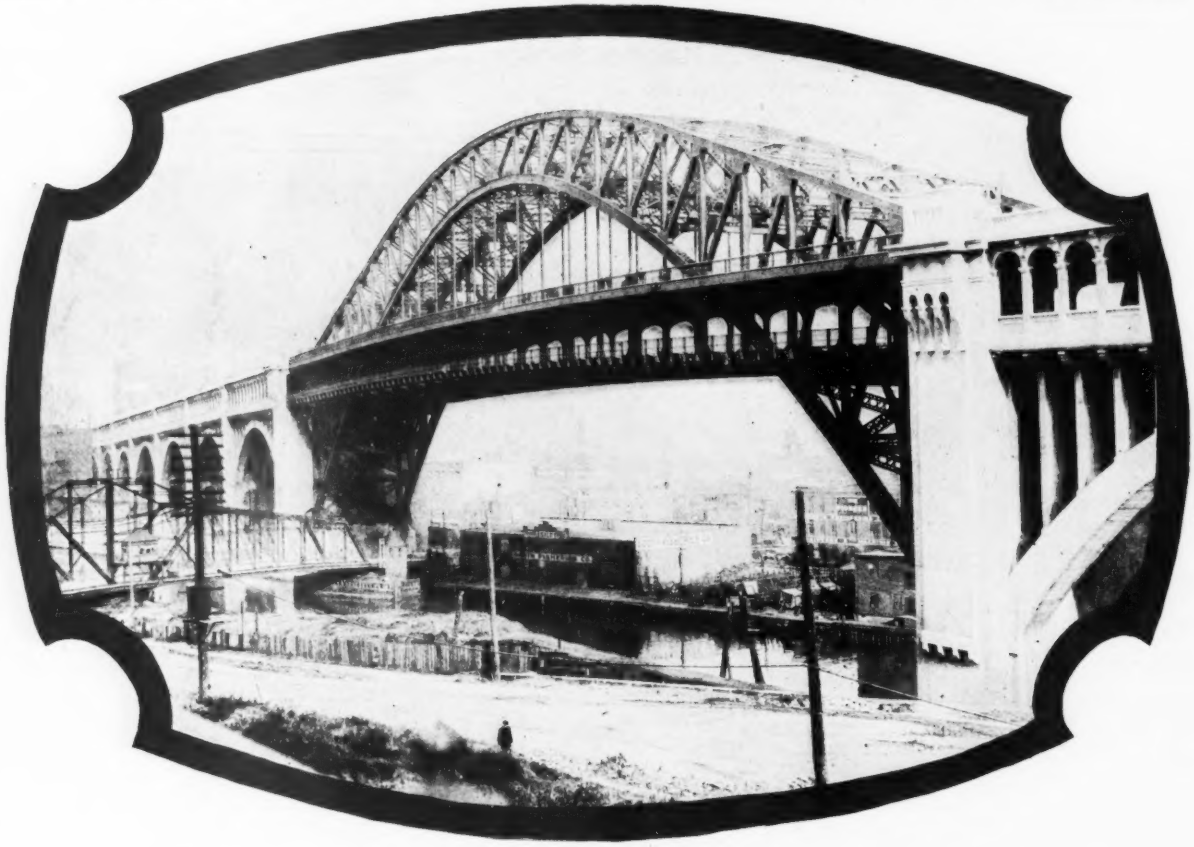

Detroit-Superior High Level Bridge, Cleveland, Ohio

Traffic survey shows that there are thirty-two thousand one hundred and sixteen (32,116) automobiles and trucks that cross over this bridge every twenty-four hours, making a total of eleven million seven hundred and twenty two thousand two hundred and forty (11,722,240) machines per year. This means that over ninety million motor vehicles have passed over this bridge since it was opened for traffic, and yet there is absolutely no noticeable wear shown on the Kreolite Wood Blocks with which this high level bridge is paved.

Kreolite Wood Blocks are made from thoroughly seasoned timber with the end-grain laid uppermost. The Kreolite Lug Block construction permits Kreolite Filler to thoroughly penetrate the joints and bind the blocks into one solid unit.

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ENGINEERING NEWS-RECORD

DEVOTED TO CIVIL ENGINEERING AND CONTRACTING

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FRANK C. WIGHT
Editor

Volume 97 NEW YORK, JULY 1, 1926 Number 1

New York's Engineers Protest

ENGINEERS in the service of the city of New York have taken a novel way to protest against the repeated refusal of the city fathers to grant them an adequate salary scale. In the advertising pages of this issue will be found an announcement of the creation of a "personal service bureau" by the organization of these engineers, which is in effect a solicitation of engineering business from outside New York City. There might be some question of the ethics herein involved if these men proposed to accept engineering commissions from the outside while holding their present position. If they did that the city would have a just complaint and other engineers could charge unfair competition. But it appears that they merely are seeking an outlet for the experience they have gained in the service of the city of New York, which the city itself does not apparently value sufficiently to reward with a living wage. Policemen and firemen and school teachers, being politically important, have convinced the politically minded appropriating authorities that they should have salaries commensurate with the rising cost of living, but the engineers still plod along at laborers' wages. The greatest city in the country has an engineers' salary scale that would disgrace a country town. How far these engineers will get with their latest move remains to be seen, but the city will get only what it deserves if it loses its best and most experienced engineers in the working grades.

Another Vindication

ONE of the principals in that section of the Department of Justice organized to prosecute the so-called war contract frauds has just resigned, and in resigning has made public a statement which confirms the opinion that the American people has had for some time; that is, that in the billions of dollars of contracts that the emergency of war precipitated there has been found only an infinitesimal percentage of fraud. Some crooked men took advantage of the situation, but by and large the Americans who did work by contract for the government were as honest as the Americans who worked for wages or fought for glory. The capital that one branch of the Republican party tried to make out of the post-war situation was obviously political in its intent, but it has taken seven years for the full force of the attack to be dissipated, and meantime its originators have passed from the public stage. The recurring vindications, of which this official's statement is the latest, are particularly satisfactory to engineers and contractors who, from the beginning, have resented the unfair attacks that were made on the construction industry by the Daugherty régime. Nothing of the charges against those who did war-time construction has been proved, and many of the accused have been judicially exonerated. The injustice of the persecution can never be remedied, but the least that the profession and the industry can do is to remember that insofar as has been possible their integrity has been vindicated.

City Foundation Excavation

PURELY as a problem of excavation and spoil disposal, building foundation construction is of major engineering importance in all large cities. It is particularly important, however, in New York City where the almost completely surrounding waters of rivers and ocean impose the necessity of water transportation to disposal areas. Virtually all excavation for buildings and subways on Manhattan Island, except the limited yardage returned as backfill, has to be trucked to the water front and discharged into scows and by them taken to sea or to areas being filled on the bay shore or in Long Island Sound. The New York Life Building foundation excavation described in this issue is a typical example of methods in the upper parts of the island where rock lies close to the surface and handling groundwater is an inconsiderable problem. The spoil from this 147,800-cu.yd. earth and rock cut was trucked to no less than eleven pier heads in a 2½-mile circle about the building site. With an output at the pit approaching a thousand yards a day the task in truck scheduling, as one or another set of these dumping places was available for use, can be readily understood. It is not only as a spoil disposal operation, however, that these big building basement excavations are heavy tasks. They are important as tasks of breaking up and removing earth and rock in close quarters, with nearby buildings to guard from damage, and in volume from considerable depths. These conditions have developed in years a technique in equipment and procedure which is excellently expressed by the work for the New York Life Building. Chiefly to be noted is the use of mechanical devices and processes—power shovel excavation, motor truck haulage making possible steep ramps out of the pits, derricks for raising spoil to trucks at street level, compressed air power plants and tools, high head pumps, blasting mats and window protectors are notable. These express power equipment of construction in about its highest degree.

Aftermaths of a Boom

LAST week the newspapers reported another one of the big Florida real estate developments in trouble. A receiver is being sought by a creditor, and while the management charges pique and claims that the enterprise is fully solvent, there is no doubt that the grand dreams of last winter are far from being realized. This is the second of the large developments which has been in public difficulties within the month. There are

several others whose financial straits have so far been kept private and a multitude of the shoe-string operations which have gone under, never to come up. It was inconceivable that anything else could happen. Speculation in the rosy possibilities of land values has never gone further than it did in Florida in the boom which culminated last winter and the attempt to capitalize in a year or two the normal development of a generation could bring only one result. The significant thing for every one to note, however, is that the technique of the Florida boom has been transported over the whole country. Everywhere one goes, on the coast of Texas, by the Atlantic City meadows, north of Chicago and near the Hamptons' gaudy shores, the hand of the Florida realtor is seen and his oily voice is heard. What they learned in Florida was to take a barren waste, land that before then was just land, useless and unused, and to add to that land by the most extravagant and impressive means the aids and trappings of a finished community. Such land, they found, could be sold, provided high-pressure selling was used, a mob desire could be aroused and a sufficiency of the engineer's and architect's and constructor's art could be applied. Such knowledge was too valuable to waste, and those who practiced it or observed it are applying the knowledge they gained, hopeful this time that they can get out with their profits before the second payments fail to arrive and the boom breaks. Engineers and contractors are the necessary aids to this technique; the part they play is honest, for they give value for what they do. But they will do well to scrutinize carefully the prospects of their pay and—though in this the ethics are not altogether clear—the justification for the project, no matter how sure seems their own pay.

Cross-Connection Advocates

WITH untiring persistence certain fire insurance companies send representatives to the water-works conventions year after year who sit ready to spring to their feet if a word is said in favor of charging for private fire protection or in advocacy of eliminating cross-connections between public water supplies and any supplies not of approved purity. With commendable patience, for the most part, the water-works men listen to these special pleadings for commercial against public interests. Rarely does a water-works man side with the special pleaders, yet on they come year after year. At the recent Buffalo convention of the American Water Works Association, four of these emissaries appeared. For an hour or more they argued for "control rather than prohibition" of cross-connections, but to no avail. The association as a whole approved the resolution prohibiting cross-connections adopted by the fire protection section last year, and referred to its executive committee the more explicit resolutions adopted by the Conference of State Sanitary Engineers, printed on p. 14. In pleasing contrast was the endorsement by engineers of the Fire Protection Committee of the Fire Underwriters Association of the anti-cross-connection movement. Much has been done but much remains to be accomplished in this campaign against what is perhaps now the greatest remaining single cause of those sudden outbreaks of typhoid fever and other intestinal disturbances once so common and now much less frequent.

A New Portland Cement Specification

SUBJECT to the approval of a letter ballot of the American Society for Testing Materials, a new standard specification for portland cement will be in force around August 1. It replaces the standard of the same society adopted in 1921, now fixed as the "American Standard" by the rubber-stamp approval of the American Engineering Standards Committee. This latter purely formal action cannot be changed without considerable more formality, so that for a time at least the elaboration of the standardization movement which the A. E. S. C. embodies has resulted in two somewhat diverging standards for this widely used material. The A. E. S. C., however, has initiated a co-operative move toward a reconsideration of the "American Standard" which in time will insure more than the mere approval of the A. S. T. M. standard and may result once more in one American standard, in which the A. S. T. M. can concur.

The new standard may or may not result in better concrete; unfortunately it is difficult to say. It is an honest effort on the part of an expert committee to provide a better cement. The attempt is made not by changing any of the methods of making the cement nor by changing any of its constituents in quantity or quality. Improvement is sought by a slight raising of one of the test requirements and by a careful revision of the methods of test, whereby it is hoped to gain not only more comparable test results on the same material but a more precise revelation through test of the properties of the material.

The committee should not be criticized for not being more radical. There are a lot of people complaining about cement who have not the slightest idea what improvements they need or even want. In the present state of the knowledge of portland cement it is highly impracticable to guarantee improved cement or improved concrete by specification improvements either in quality definition or methods of relating test behavior to structural behavior. This the committee recognized, but it also has been forced to recognize the growing demand for a higher strength test and the necessity for doing something to increase concordance of tests.

The strength increase amounts to a specified 25 lb. in the tension test and a possible additional 25 lb. due to the limitation of pressure upon the briquette in molding. This merely means that the 1 or 2 per cent of current rejections will be doubled under the new specification. It would be a highly sanguine engineer who believes that he is going to get a very much better cement thereby, and a still more sanguine one who will use it to increase the estimated capacity or longevity of his structures. What the user will get will be a cement the weakest of which will test 25 to 50 lb. higher in a tension briquette than the weakest under the old specification; he is entitled to his own deductions as to how that will benefit him.

On the other hand the changes in the method of testing are important, in that they tend to make more reliable the reported qualities of the cement. This is a fundamental necessity of all specification. What good does it do to require certain properties if two people cannot report alike on those properties? And to a degree that has been true in cement testing. Nothing that the new specifications can do will prevent slipshod or dishonest testing, but they will at least help honest

and skillful operators to standardize the personal equation so that there will be more assurance that a test reports the qualities truly, regardless of whether knowledge of those qualities is needful or not.

Those responsible for the adoption of this new standard should not assume that all knowledge regarding cement is now crystallized for another decade. If it did that the worst enemies of the standardization movement would be justified in their beliefs, for it would mean that the dead hand of conformity had been laid on scientific curiosity. It does not answer the queries regarding cement properties and the behavior of concrete that are becoming more and more numerous and authoritative. It does mean that for a time the best concerted thought has been unable to discover anything regarding cement that will permit of its description in much different terms than are now accepted and has been unable to devise any new way to simulate its behavior in the finished structure.

Concrete is far from perfect. Study of cement is therefore demanded, no matter how thoroughly are studied the other materials and methods that go to make concrete. Due to the rapidly increasing interest in concrete behavior, we are in a fair way of learning soon much more about cement and concrete, and that knowledge must be incorporated in the specification. And, the commercial considerations to the contrary notwithstanding, it is not incredible that use will be found to control performance to such an extent that one specification will not suffice to define the varying quality of cement required.

Research vs. Specifications

ANYONE contemplating the vast activities in the direction of standardization that have been current for some years, might rather easily have fallen into the belief that scientific and technical knowledge is fairly complete, and that the only important work left is the systematic and orderly use of that knowledge in everyday work. Among the activities which contributed to such a belief was the extensive standardizing work of the American Society for Testing Materials. But within the last two or three years the work of that society has accorded an increasingly prominent place to research. New observations on the behavior of materials in service as well as in test have been reported and discussed in increasing amount. The 1926 meeting last week continued this same trend. Not that there was less standardizing activity than heretofore—as a matter of fact, the reports of specification committees were possibly more numerous than ever before—but nevertheless the meeting had its center of gravity in non-specification matters, namely its technical and scientific papers. The new information dealing with endurance, with high-temperature strength, with corrosive destruction of steel, with the behavior of duralumin, cast-iron pipe, paint and the like, provided far more food for thought than did the specification work.

This is gratifying. There has been more than a suspicion that standardizing has been carried on with somewhat abnormal zeal—as a cult rather than as a reasoned pursuit. While the committee work of the American Society for Testing Materials could never be seriously indicted on this count—since it largely grows out of specific industrial demands and indeed often merely puts into words the existing unwritten standards of commercial performance—yet it was affected by the influence of the general drift. Therefore it is useful to note that more fundamental work is now again taking the lead.

For the same reason, too, it is quite fitting that the Edgar Marburg lecturer took as his theme one phase of research work, the laborious steps by which knowledge of one of our youngest materials, reinforced concrete, was worked out. So long as men of the research type of mind continue to be represented in the high places of the society, there is good promise that the present healthy development will maintain itself and that the society will continue to be in the main a creative body rather than one merely engaged in compromising, adjusting and voting on the mutual issues between producer and user of material.

Eight Conflicting Groups

MANY conflicting interests are maneuvering for position in and out of the special session of the New Jersey Legislature which convened on June 22 to deal with state water questions. Whether the session will legislate or procrastinate still further is uncertain with the chances good for procrastination. At least eight groups, each with its own special interests to conserve, are more or less in evidence. These are: (1) The public, individually and collectively, as consumers of water and as purveyors of water to be consumed—largely apathetic, as for the past half century. (2) Private water companies—now as always alert. (3) The people and industries of the rural areas from which water is or must be drawn—with varying degrees of alertness. (4) Owners of water power, developed and undeveloped—mostly alert. (5) and (6) A state and a district board, one charged with conserving the water interests of the state, the other a water development agency for a group of municipalities, each fearful of losing some of its powers to the other or to some new board or boards. (7) The legislators and governor who, subject to certain vested rights, the constitution and the courts, have full control of the waters and water policies of the state but many of whom fall more particularly in our next and final class. (8) Back of or intertwined with the other seven, but with interests peculiarly their own, the political parties.

Whether by chance or intent, the self-arranged special water session of the legislature met just as the political parties were hewing platform planks and grooming candidates for the November election. No wonder, then, that after the introduction of a number of bills and a gesture to the public in the form of fixing a date for a hearing, adjournment was taken for a week. Already there is earnest advocacy in some quarters of ending the special session with a minimum of action, leaving the voters with promises and hopes until after the November election and the regular legislative session early in 1927. Whatever else is done or left undone the necessarily slow-working machinery for a constitutional amendment should be set in motion at once so that whatever water-supply plan is finally adopted there will be less roundabout ways of finance and administration than under the existing water and sewer districts.

Digging a Million Dollar Cellar, New York City

Excavation of Old Madison Square Garden Area for New 30-Million-Dollar Office Building Opens a Pit 425 x 197½ Ft. and 42 to 72 Ft. Deep

By M. F. McKenna
Field Superintendent, George J. Atwell, Inc.,
New York City

OPEN pit excavation typical of progressive practice in building foundation work in those sections of Manhattan where rock is comparatively near the surface, is illustrated in the operation for the New York Life Insurance Co. building on the old site of Madison Square Garden. Here a pit is being opened for an area of 425 x 197½ ft. to a maximum depth of 72 ft. below curb level, requiring 147,800 cu.yd. of excavation of which 124,800 cu.yd. are rock. The cliff-like height of the pit walls, where the excavation is deepest, is indicated by Fig. 2. And this great rock hole is being opened as shown by Fig. 1 with heavy-traffic street on each of its four sides and with large buildings facing it on three of these streets. The conditions in brief are typical mid-city New York building excavation conditions except that few individual operations include so great an area. Therefore the methods and equipment are generally indicative of modern practices as well as being specific examples in a particular operation of especial magnitude.

FIG. 1—BASEMENT EXCAVATION 425x197½ FT. FOR NEW YORK LIFE BUILDING
Eight derricks around sides raised 80 per cent of excavation (total 147,800 cu.yd.) and remainder was removed by motor trucks and ramp.

Governing Conditions—The contract allowed 150 days for the excavation which called for an average of about 1,000 cu.yd. a day earth and rock removal. In the actual work, delays in access to the whole site and other hindrances which arose prevented the nominal time limits being lived up to but as the work was projected quantity output had to be planned in equipment and means of disposal. This was the inclusive controlling condition, and it was by no means uncomplicated.

Reference to the diagram plan, Fig. 3, shows that two-thirds of the cut was to a depth of 43 ft. 7 in. and one-third was to a depth of 71 ft. 7 in. About one-sixth of the yardage, all rock, had to be raised from between the two elevations named. The site was, as shown, bounded on all four sides by streets. This gave the maximum footage of access but the streets were all important and carried heavy traffic and their use by the contractor had to be restricted to city ordinance limitations. These allowed derrick emplacements to extend 8 ft. outside the curb and the stopping of trucks for loading next to the curb between derricks. Hauling away the excavated material, therefore, had to proceed as fast as it was raised. Opposite the site, across three of the streets were buildings, generally, as shown by Fig. 1, of considerable height and all of heavy construction, and having extensive window areas, to be guarded

FIG. 2—DEEPEST CUT TO 71 FT. 7 IN. BELOW CURB
The rock is a gneiss and was raised in 2-cu.yd. skips by derrick at street level and loaded into trucks. Note the two basement levels, the lifts blasted, the drill lines and the pump with a total lift of over 70 ft.

against foundation disturbance and damage by blasting.

These conditions—quantity output, deep excavation, limited utilization of street area and protection of adjacent buildings—indicated to the contractor preference for the general plan: (1) Excavation over the whole area at once and removal of spoil from all four sides. (2) Because of the depth of the excavation, raising the material by derricks and, to keep the pit bottom unobstructed, placing these derricks at street level all around the pit perimeter. (3) A ramp and trucks for "taking out" the center "dead area" unreached by the derricks; this applying only to the upper subgrade level of 43 ft. 7 in. (4) A retaining wall to hold the pit sides above solid ledge level to eliminate pit obstruction by the braces required if sheeting were used. The governing thought it will be observed was full-area operation with a field clear of obstacles to blasting and power

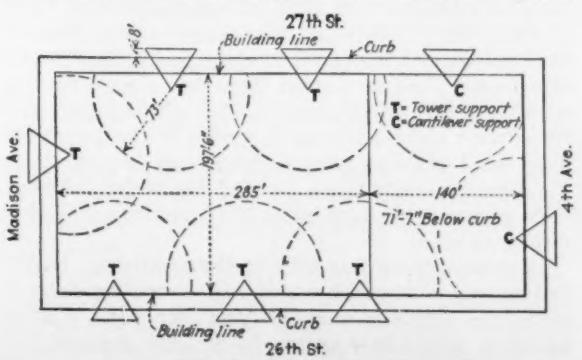


FIG. 3—PLAN OF PIT DIMENSIONS AND DERRICK LOCATIONS

shovels and a minimum of non-mobile plant shifting. Failure because of permit complications to get all the site cleared as soon as was anticipated hampered at first the full functioning of the plan but it was carried out in general as indicated by Figs. 1 and 3.

Derrick and Plant Location—Eight derricks were set up around the pit perimeter as shown by Figs. 1 and 3. On Fig. 3 the arcs indicate the full possible range of the derricks. They are 10-ton machines with 73-ft. booms and handle 2-cu.yd. steel skips. As stated the rear sills of the derricks could not go more than 8 ft. outside the curb. This restriction brought the foot blocks within the edges of the excavation and they had to be supported from inside the pit. Where the derricks were over the shallower cut, wood frame towers were built as indicated by Fig. 2. For the two machines overhanging

FIG. 4—CANTILEVER SUPPORT FOR DERRICK FOOT BLOCK
This support used only for two derricks serving deepest pit; towers used for derricks serving shallower cut.

the deeper cut brackets were constructed as shown by Figs. 4 and 6. The ends of four I-beams were cut into the vault wall and an enveloping block of concrete was built on the ledge under the vault; all details are clearly indicated by Fig. 6. This cantilever support left the pit below entirely clear for excavation. Where the towers were used pillars of ledge were left as shown by Fig. 2, later to be taken out by power shovels and trucks.

The compressor outfit formed most of the remainder of the stationary plant. This was located in the sidewalk vault space on the Fourth Ave. side and consisted of two belt-driven machines with a combined capacity of 2,500 cu.ft. of free air per minute. These compressors delivered into a 6-in. pipe line entirely around the pit. From this main, at intervals, 3-in. pipes extended down into the pit. There 2-in. hose, with manifolds for six drill connections, were coupled on as was desired.

FIG. 5—SECTION OF RUBBLE RETAINING WALL
This wall retained earth above ledge doing away with sheeting and inclined bracing into pit.

Excavation and Hauling—About 23,000 cu.yd. of the total 147,800 cu.yd. of excavation were earth and old building walls above ledge rock. This material was loaded by shovels to trucks in the pits or was raised by derricks handling to trucks at the curb or on loading platforms bracketed over the pit. These were the ways also of handling the rock and this was a rock operation, there being 124,800 cu.yd. of gneiss to be drilled and blasted. About 80 per cent of all material was handled by the derricks. All of it was truck hauled.

As there were streets on four sides to be held when the cut to ledge was made and heavy buildings across-

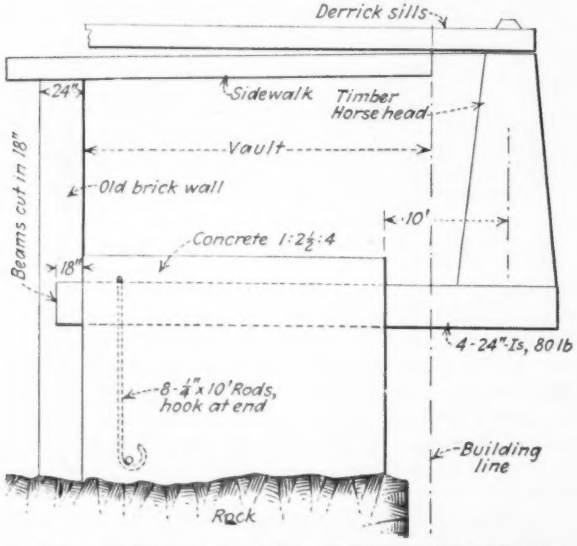


FIG. 6—DETAIL OF CANTILEVER DERRICK SUPPORT

street on three fronts, retaining the earth cut became a primary problem. Customarily sheeting held by inclined bracing to the pit bottom has been the practice, but here the depth of cut made bracing a considerable task and always, of course, it is a hindrance to free operation in the pit, so the contractor turned to a gravity wall to hold the pit sides above ledge. The material for a masonry wall was in the pit, so a rubble wall in cement mortar was adopted. An 18-in. concrete footing doweled into the ledge carried the masonry. The wall can be seen in Figs. 2 and 5; there were 1,200 ft. of an average height of 18 ft. It worked out a little less expensive than bracing and gave an additional gain

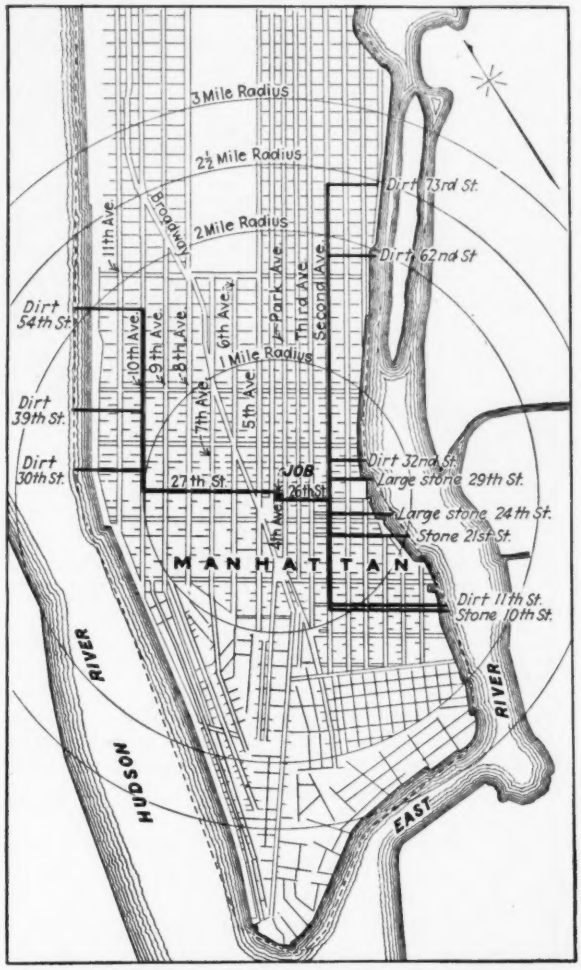


FIG. 7—DISPOSAL PLAN FOR EXCAVATED MATERIAL

of a clear pit for excavation and steel erection—an unobstructed pit area of 83,000 sq.ft.

Drilling and blasting kept to city ordinance requirements. All blasting was done between 7 a.m. and 7 p.m.; small charges were used and covered with mats, and adjacent windows were fitted with anti-vibrators. About 35 drills were operated on the average; about 42 at the peak output of 1,400 cu.yd. in eight hours. Besides the compressor plant mentioned there was a machine shop with forge and drill sharpener. The pit was dry except for surface water and a small spring in the deeper cut. Two small gasoline pumps, one shown in Fig. 2 and the second a centrifugal, handled the water; at times these pumps worked against a 20-ft. suction and a 50-ft. discharge head.

In general there was little in the excavation, loading and raising of the rock which was other than ordinary except the output in quantity from deep pits. Whether loaded by shovel in the pit or by derricks at street level motor trucks took all material to the river fronts for disposal by scows. With outputs up to 175 cu.yd. an hour, careful truck routing had to be worked out. Fig.

7 shows the docks at which disposal was practicable, the kinds of material which they would handle and their distances from the work. The heavy lines indicate the routes laid out to interfere the least with traffic. All routing and scheduling was done from the construction office which was always in touch with the foremen at the dumps.

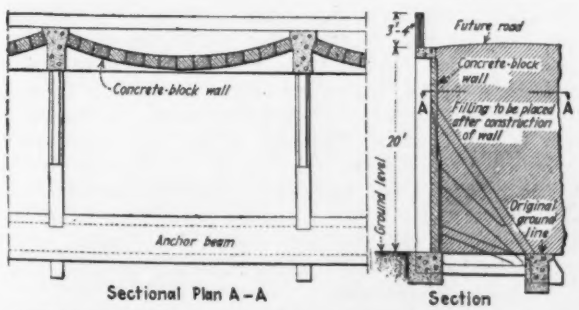
Direction and Personnel—The operation in general is a problem in direction. Under the physical conditions the contractors had to co-ordinate equipment and processes in drilling, blasting, loading, raising and hauling so that for the time limit of 150 days set by contract an average of almost a thousand yards a day could be maintained. This work was under the direction of George J. Atwell Co., Inc., New York, excavation contractors, and Starrett Brothers, New York, general contractors. Joseph A. Walsh is general manager and M. F. McKenna is field superintendent for Atwell. The building is estimated to cost $30,000,000. The contract for excavation was about $1,000,000. Cass Gilbert is the architect.

Arch Retaining Wall in India Built of Concrete Blocks

A NOVEL type of retaining wall has lately been built at Ahmedabad in India, in connection with the approach road to a railway over bridge. These walls have been placed on either side of the road right-of-way, a subsequent fill between the walls carrying the roadway.

As shown in the accompanying drawing, the design consists of a horizontally arched wall of concrete blocks placed on a reinforced-concrete foundation beam. These horizontal arches are built between skewbacks cast on a vertical counterfort held at its base by the foundation beam and at the rear by diagonal ties securing it to an anchor beam. The fill for the roadway bears on this anchor beam, preventing overturning.

High prices for cement and reinforced-concrete construction, in comparison with brickwork or rubble masonry, make this a very economical structure in



RETAINING WALL OF CONCRETE BLOCK ARCHES AND REINFORCED-CONCRETE COUNTERFORTS

India. The reinforced-concrete members are mostly near the ground, so that costly formwork is eliminated. Only the diagonal and vertical members require extra careful formwork.

The work was done by J. C. Gammon, Ltd., engineers and contractors, of Bombay, India. An English patent has been obtained for this type of retaining wall, according to *The Engineer*, London, from which this information on the wall has been obtained.

Snow Surveys and Stream Runoff in the Sierra Nevada

A COMPARISON of actual runoff in the Sierra range with the runoff forecast or predicted on the basis of snow surveys conducted by the Nevada Co-operative Snow Survey, indicates the value of the surveys, as shown by the accompanying summarized table for 1924-1925.

In this table, the deficiency of 8.8 per cent in the Truckee basin is within the range of 10 per cent which is acceptable under present methods. Of the excess in the Lake Tahoe basin, 7.6 per cent is due to excess precipitation on the lake and probably 5 per cent addi-

FORECAST AND ACTUAL RUNOFF: 1925–1925

Basins	Runoff — Forecast in April — Probable	Possible Maximum	Actual	Excess Precipitation April–July
	Per cent of Normal			
1. Truckee	64.2	64.2	55.4	....
2. Lake Tahoe	80.2	90.2	101.2	47.6
3. Carson	77.9	87.9	75.2	173.2
4. West Walker	85.1	95.1	88.7	110.1
5. South Yuba	....	75.7	104.0	41.3
6. Mokelumne	83.0	93.0	95.7	52.0
7. Humboldt	73.8	....	110.1	76.6

tional to such precipitation on the drainage area. The deficiency in the Carson basin, in spite of excess rainfall, is attributed to diversions above the gaging station, which is near the lower end of the stream. In the West Walker basin, the actual runoff was only 3.6 per cent below the "probable" and 6.4 per cent above the "possible" of the forecast. For the South Yuba basin, about 10 per cent of the excess is attributed to excess rain; the remaining 18.3 per cent is due to lack of precipitation records and perhaps to errors of an inexperienced snow-survey party. For the Mokelumne basin, the actual runoff was 12.7 and 2.7 per cent above the predicted "probable" and "possible," respectively. For the Humboldt basin, the excess of actual over predicted runoff was due to lack of complete snow surveys and to the continuance of frequent and heavy rains through July.

In a report on sixteen years of snow surveying in the Central Sierra, by J. E. Church, Jr., in charge of the Nevada Co-operative Snow Surveys, the following statement is made:

Snow surveying under the percentage system as conducted by the Mt. Rose Observatory is based upon two fundamental facts: (1) the approximate uniformity of the snow cover over wide areas, and (2) the intimate relationship in the Western mountains between winter snowfall and the spring-summer flow. During the sixteen years of field work, only two disturbing factors of major importance have been found: (1) Premature melting of the snow cover at lower levels, and (2) deficiency in normal precipitation during April-July. The former can be determined and measured by means of low-level snow courses at the time of the annual snow survey made on April 1. The probability of the latter can usually be determined and its results estimated by May 1 or at the latest by May 15.

Six basins are included in the series and are situated on both sides of the range. Of these, the Tahoe, consisting mainly of a lake, is greatly affected by precipitation upon its surface; the Carson has large diversions above its point of gaging, and the Mokelumne possesses only crest snow survey stations, depending for its outpost estimates upon measurements in the South Yuba basin, which is separated from it by the wide American Basin. Yet out of 54 forecasts for the entire six basins, 29 forecasts were within 10 per cent of the actual runoff, while 14 were within 20 per cent. In the remaining 11, the maximum divergence between snow cover and runoff was only 30.4 per cent.

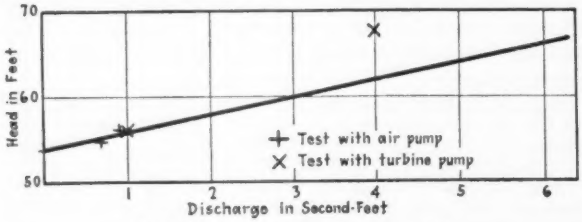
Well Sinking and Tests for the City of Los Angeles

Methods Employed to Supplement the Gravity Flow To and Through Los Angeles Aqueduct in Dry Seasons

By George R. Shuey
Superintendent and Resident Engineer, Well Operations, Aqueduct Department, Los Angeles, Calif.

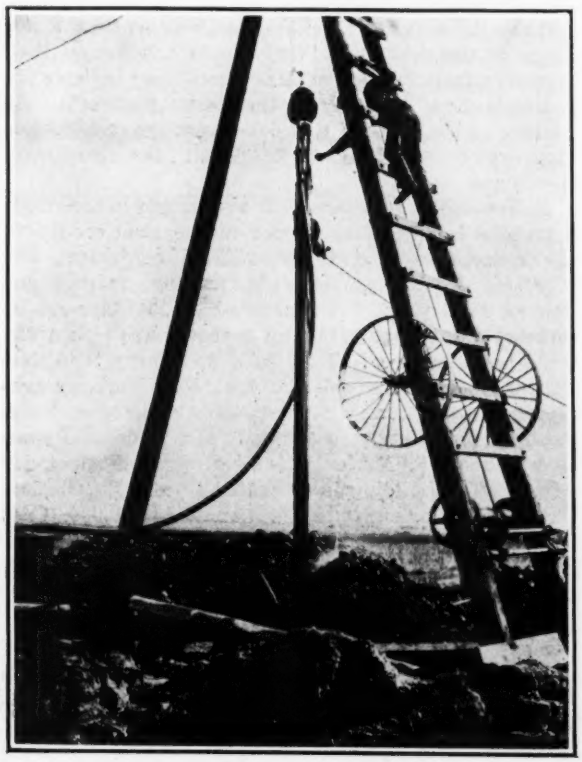
At the head and source of the Los Angeles aqueduct is Owens Valley, a deep trough-like depression between two high mountain ranges. The Sierras on the west reach their highest point, culminating in Mt. Whitney, and furnish the water supply of the valley. The debris from the Sierras, grading from coarse granite boulders on the upper slopes through gravel and sand on the intermediate slopes into silts and clays in the valley floor, is very deep. The leakage from the streams, which debouch from the Sierras onto large gravel cones, and the spreading of water for irrigation, have saturated the lower lands of the valley. The city in developing its water supply for its aqueduct has taken advantage of the storage afforded by this condition to drill many wells and pump from them during periods when the gravity supply has been short.

The extent and value of this auxiliary source was early recognized by William Mulholland, chief engineer, and the first prospect well was drilled in 1908. During the three years, 1908-11, 17 wells were drilled, in different parts of the Independence Basin. (U. S. G. S. Water Supply Paper No. 294, by Charles H. Lee, was a systematic study of the hydrology of the region, made as a part of this general investigation under the direction of Mr. Mulholland.) From 1911 to 1917, the aqueduct was fully supplied with water from gravity sources. The dry cycle, which began in 1917, caused a water shortage, and in the years 1919-1920 32 more wells were driven. These were in the artesian belt, which had been located by the earlier exploratory wells. An air-lift was installed, and sixteen wells were pumped, to 1924, when turbine pumps replaced the air lift.



TEST CURVE FOR WELL NO. 206
Located at Fish Springs, Calif. Tested Feb. 25, 1926. Depth of well, 154 ft. Static water level, 54 ft.

The amount of water that was being pumped by air was much less than the engineers believed the basin could be made to yield, so a new drilling campaign was inaugurated in 1923. A careful study of the wells in service showed that those on the highest contour, in coarser material, were capable of producing much more water than wells lower down the slope. The static pressure was sufficient to cause the lower wells to flow, while in upper wells the water stood from 30 to 50 ft. below the surface. The distance between the general alignment of the upper and lower wells is from one-half to three-quarters of a mile, but in this distance the formation changes from boulders, gravel and conglomerate, in the upper tier of wells, to sands, fine gravel and clay in the lower line. As compared with the lower wells, the upper wells have a much lower lift and power consumption and a yield more than double. This is due to the open character of the formation through which the water reaches the upper wells.



TRIPOD AND EDUCTOR LINE SET OVER WELL

The city owns and operates all drilling and testing machinery. Eight rigs of the Southern California type are in service. All wells are of double stovepipe casing. Plates of No. 12 gage were used for the 12-in. wells, and have been generally satisfactory. When the change to 16-in. size was made No. 12 gage was first tried. Several wells collapsed due to the lightness of the casing, and swaging was an every day occurrence in drilling. Next we tried No. 10 gage, and had fewer collapses and less swaging, but on account of the boulder formations and the necessity of using four jacks, our standard now is No. 8 gage. Swaging is now infrequent and collapses are unknown. The use of No. 8 gage casing has introduced a new element of difficulty—in perforating—to overcome which a special perforator, operated by a hydraulic jack, has been designed and built. This perforator has six blades, which cut simultaneously, and is working satisfactorily.

After a well is drilled and perforated, the next step is to develop and test it. We have tried two methods. One way is to use a test pump, with a suction line to the bottom of the well, as described by me in your issue of May 14, 1925, p. 820. This has some desirable features. The large capacity pump affords a wide range of discharge and a good curve of the well capacity; discharge in terms of drawdown can be plotted. Much sand and silt can be pumped out, but the mixture of sand and water cuts out pump bearings very quickly, and the suction line sometimes gets buried in sand, or caught by a well collapse, resulting in a bad fishing job.

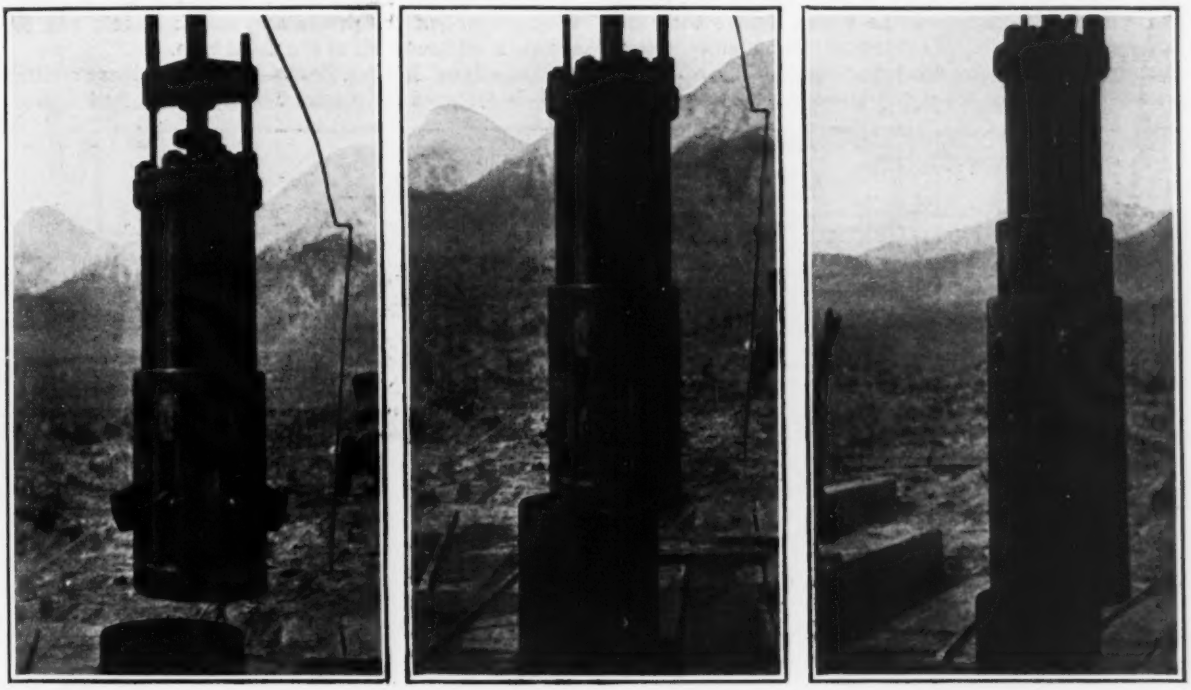
The other method of developing, cleaning and testing is by use of compressed air. Two portable units are in use, each having a free-air capacity of about 250 ft. A 6-in. eductor pipe is placed in the well, down to a point where the submergence is sufficient to cause it to operate efficiently, and where it will not be likely to plug up with sand. Air is introduced at the side of the pipe. Pumping with air brings sand and silt through the perforations of the well, and they are carried out through the eductor line. By closing a valve on the eductor pipe a column of water is forced to the top of the well. Then the valve is opened, and the column of water drops. This surges the well, and opens up the strata. As fast as the well clears, the eductor pipe is let down, and finally reaches the bottom. It sometimes takes a week to get to the bottom.

The removal of material from the lower strata creates cavities that need to be refilled. Caving along the casing is encouraged, by turning water down alongside, or drilling an open hole at the side of the casing. Gravel and rock are introduced to fill the cavities caused by pumping. This is one way of getting a gravel envelope for a well. One well that was 160 ft. deep, took 180 yd. of rock to fill the voids. A well developed in this way is a finished product. Very little sand can be pumped out, after a permanent installation. Next a drawdown curve is made, by pumping with varying quantities of air, and getting the corresponding discharge and drawdown. The points obtained in this way, with the static level, are used to plot the curve. The maximum capacity is about 1.2 sec.-ft. This curve usually plots as a straight line. The curve produced beyond the maximum sometimes falls below the actual discharge, as determined later by the pump. However, the slope of the curve is usually close enough to serve in selecting the pump and motor to be used, and if one is conservative it is seldom that changes are required.

The extensive debris cones, between the base of the mountains and the well field in Independence Basin, over which the streams now run, are very coarse, and have great absorptive capacity. These offer a fine field for the spreading of flood waters, to augment and replenish the ground-water reservoir, which is pumped out in dry years. This storage of peak flows will conserve water now partly wasted and will cut down the surface storage at the head of Owens River.

The conclusion reached by Lee in Water Supply Paper 294 were that Independence Basin was losing from ground water, annually, by evaporation and transpiration from grass lands, evaporation from spring flow, and discharge of springs into Owens River, an average of 132 sec.-ft. or 96,630 acre-ft. per annum. The city now has a total pumping capacity of 170 sec.-ft. in this basin, which is 123,000 acre-ft. per annum. It will be an interesting experiment to test the basin by continuous pumping over a period of years and determine the actual quantity that can be pumped and compare this with the theoretical quantity determined by Lee.

William Mulholland as chief engineer, with Roderick McKay (now deceased) and H. A. Van Norman at present assistant chief engineer, and the writer as superintendent and resident engineer, has had charge of the well development in Owens Valley.



HYDRAULIC PERFORATOR FOR WELL CASINGS

Left: Blades in cutting position. Center: Blades drawn in ready to lower. Right: In action, with blades extending through casing

DATA OF OWENS VALLEY WELLS, LOS ANGELES WATER SUPPLY

No. of Wells	Date Drilled	Size, In.	Av. Depth, Ft.	Av. Cost per Ft.	Av. Producing Capacity per Group Sec.-Ft.	Cost per Sec.-Ft.†	Remarks Use of Wells
17	1908–1911	12	345	$7.50*	17	$2,587	Aq. supply
32	1919–1920	12	313	8.54	27	3,168	Aq. supply
52	1923–1926	16	304	10.50	96	1,739	Aq. supply
15	(Purchased)	12	110	.....	30	....	.....
24	1925	12	133	6.50	..	....	Domestic
9	1926	16	396	10.93	30	1,266	Irrigation
149							

* Estimated. †Total, 200 sec.-ft., of which 170 is from wells put down by city and 30 from wells purchased.

Activated-Sludge Plant for Three Small California Cities

Excess Sludge Returned to Imhoff Tanks, Residue to Drying Beds—Effluent Not Sent to Old Sewage Farm Is Chlorinated—Design Features of Comprehensive Plant

By F. M. Veatch
With Black & Veatch, Consulting Engineers,
Kansas City, Mo.

CONSTRUCTION was started last November on an activated-sludge plant to treat the sewage of Pomona, Claremont and La Verne, Calif. The population of the three cities is some 22,000 but since approximately 5,000 persons are being successfully served by an existing sewage farm and since some 2,000 persons reside on another drainage area the new plant has been designed to serve 20,000 population. The sewage is domestic in character and of average strength. Storm water is excluded from the sewers. The main features of the plant are an Imhoff tank for pre-sedimentation, to which excess sludge will be returned for digestion and from which the final sludge will be drawn to sludge-drying beds; Dorr clarifiers used for final sedimentation; chlorination for such of the final effluent as is not sent to the existing sewage farm.

Sewage Flow—The sewage flow upon which the design is based is 75 gal. per capita or 1.5 m.g.d., with a maximum rate of 150 per cent of the average or 2.25 m.g.d. The sewage will pass through preliminary settling tanks of the Imhoff type before being treated by the activated sludge process and in the final effluent will be chlorinated. Dorr clarifiers will be used in the final settling tanks. Provision has been made for the digestion of the excess activated sludge in the sludge compartment of the preliminary settling tank, and for drying it on sand beds of the usual type.

Preliminary Settling Tanks—The preliminary settling tank is designed for a total detention period of approximately 48 minutes in four settling compartments each of which has a detention period of about 12 minutes average flow, or approximately 10 minutes daytime flow. The sludge digestion chamber is in the form of a tank with four hopper bottoms and has a capacity of 40,000 cu.ft., or approximately 2 cu.ft. per capita, which capacity is approximately 50 per cent greater than that required for proper digestion of fresh sludge in this climate, as shown by experience at Whittier and other southern California cities.

The convenient measurement of the raw sewage at a plant of this kind is essential, and is provided for by a distribution box with four weirs and receiving chambers each of which is connected with one of the settling compartments. This arrangement will allow equal distribution in the settling compartments. A recording water-level gage, mounted over the distribution box,

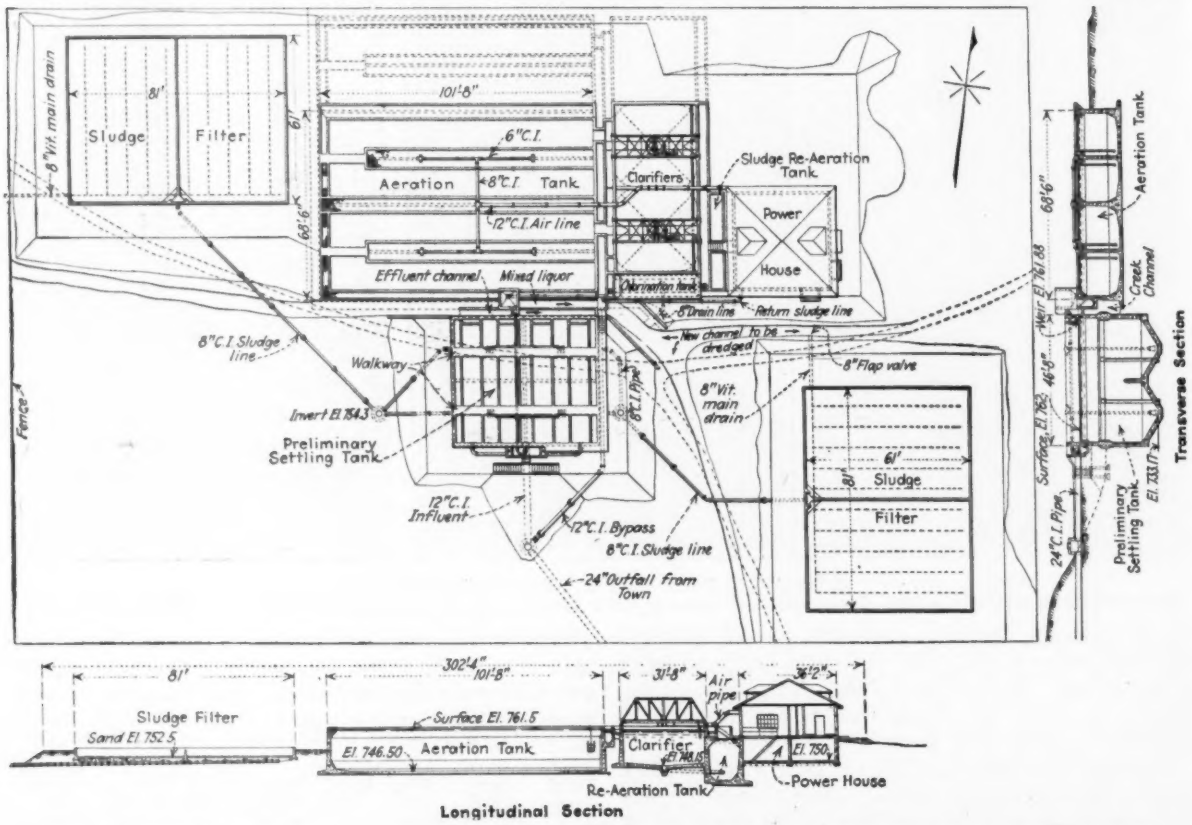


FIG. 1—GENERAL LAYOUT OF ACTIVATED-SLUDGE PLANT FOR POMONA, CLAREMONT, AND LA VERNE, CALIF.

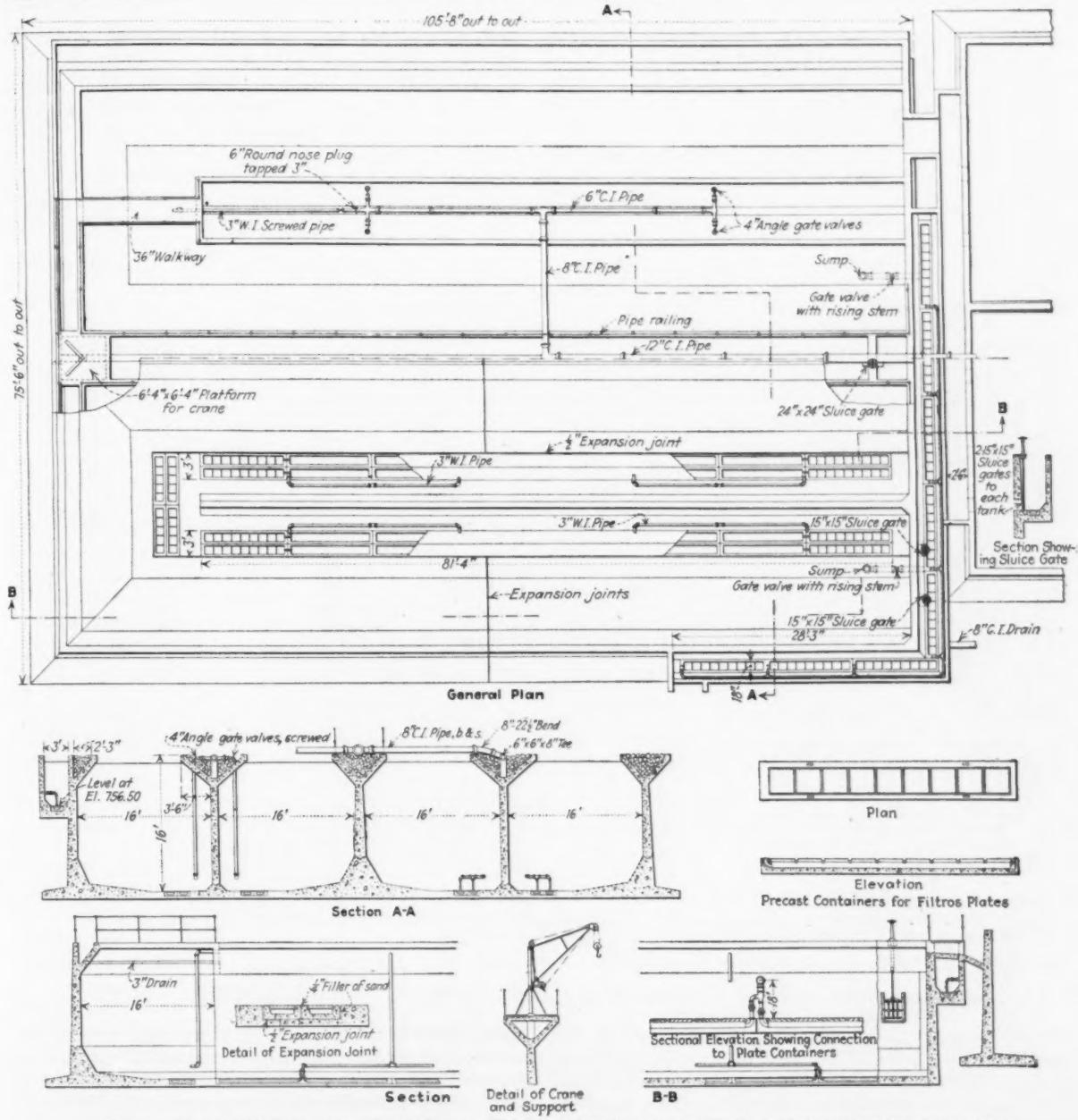


FIG. 2—PLAN, SECTION AND DETAILS OF AERATION TANK FOR POMONA ACTIVATED-SLUDGE PLANT

will provide a continuous record of flow. Other design features of the preliminary settling tank are: A 5-ft. free-board between the normal water level and the settling compartment walls; a gas-vent area of 900 sq.ft. or 38.4 per cent of the total area of the sludge digestion chamber; and steel deflectors, submerged to a depth of 3 ft., substituted for the conventional entrance baffle. The excess free-board and gas-vent area are for the purpose of cutting down the effect of foaming as far as possible. The tank effluent will be drawn off over four 7-ft. weirs into an effluent flume which discharges into the mixed liquor channel, and also receives the return activated sludge from the re-aeration tank.

The amount of sludge to be returned will be regulated by a division box with an orifice and waste weir, the orifice to be changeable to suit operating conditions and the waste weir to discharge into a sludge pipe leading to the tank inlet, with branches to each of the hoppers. The waste sludge can therefore be passed through the tank with the raw sewage or fed directly into the sludge-digestion chamber. Studies by Dr. Imhoff (*Engineering News-Record*, June 4, 1925, p. 936) indicate that the waste sludge should be fed into the raw sewage, but it seems advisable that provision be made for introducing at least part of the waste sludge directly into the sludge digestion chamber.

It is intended to return activated sludge to the extent of 20 per cent of the daytime flow at first and to adjust amount later as results indicate. The tank is fitted with a bypass which will allow the sewage to be fed direct into the mixed-liquor channel or into the creek. Sludge will be removed by gravity by four conventional sludge eduction pipes one of which is located in each hopper.

Mixed-Liquor Channel—The mixed-liquor channel extends from the distributing box to the inlets of the aeration tanks and is a hopper-shaped flume 3 ft. wide and 5 ft. deep, fitted at the bottom with a single row of aerator plates through which air will be forced to prevent settling. This flume will be cast integrally with the aeration tanks, and, as is the case with other flumes and open spaces throughout the plant, will be covered with "subway" grating and can be used as a walkway.

Aeration Tanks—There are two aeration tanks, each 32 by 106 ft. in plan, with a water depth of 15 ft. and wall between the two tanks will permit the use of the tanks in series should this prove to be desirable.

Aerator Plates—Grade R Filtros plates 12 in. square by 1½ in. thick will be mounted in precast concrete containers in groups of nine and five. The ratio of plate surface to total area measured below the deflectors is approximately 1 to 10. A small hand-operated swinging crane will be permanently mounted at the end of the division between the two aerators to facilitate handling of the plate containers.

Final Settling Tanks—Two 30-ft. square settling

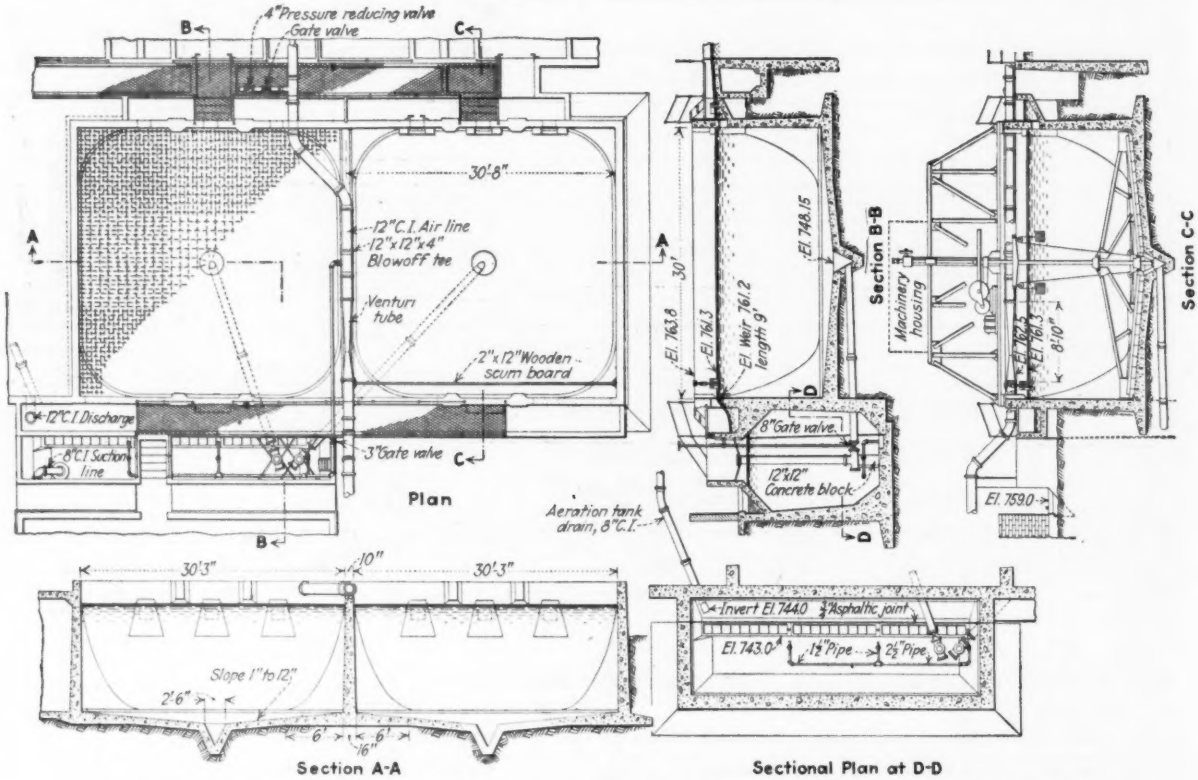


FIG. 3—DETAILS OF FINAL SETTLING TANKS AND SLUDGE-AERATION TANKS, POMONA, CALIF.

a total capacity of approximately 6-hours flow at the maximum rate, plus 20 per cent of returned activated sludge. Each tank is divided by a longitudinal baffle into two 16-ft. channels which will be used in series and will provide about 200 ft. of travel. The tank walls are of cantilever construction throughout, with sheet lead expansion joints both transversely and longitudinally. The walls are capped with deflectors, and along the side of the bottom of each channel a double row of aerator plates will be placed so that the rising air will cause the sewage to take a spiral motion and thus hold the air bubbles in contact with the sewage for a longer period than would be the case were the vertical rise not deflected. It is also anticipated that less air will be lost at the surface.

The deflectors will be cast integrally with the walls and will form triangular troughs which will be filled with gravel to provide walkways along the walls. The mixed liquor formed of the settling tank and returned activated-sludge effluent will enter each aeration tank through two 15-in. sluice gates set 5 ft. below the water level and will be drawn off over weirs into the final settling tanks. A 24-in. sluice gate set in the division tanks with a combined capacity of one hour's maximum sewage flow plus 20 per cent of returned sludge will be provided and will be equipped with clarifiers. The two tanks have a combined surface area of 1,800 sq.ft. Under maximum conditions this will mean 1 sq.ft. of surface for each 1,500 gal. of sewage per day. The sewage will enter each of the tanks, which will be operated in parallel, through three 24-in. ports and be drawn off over three weirs which have a total length of 24 ft. An adjustable scum board, submerged 1 in., will be installed 18 in. ahead of the outlet weirs.

Sludge will be removed from the two tanks by 8-in. sludge pipes which terminate in outlet tees in the sludge re-aeration chamber, which pipes will be fitted with orifices set 3 ft. below the water level in the settling tanks. The tanks may be drained into the re-aeration chamber, and the sludge flow will be regulated by valves operated from the walkway above. This arrangement will permit convenient sludge measurement and sampling.

Chlorination Tank—The effluent will be drawn off over a 4-ft. weir and either discharged directly into the creek, in which case it will be chlorinated, or into the

old outfall sewer through which it will flow to the old sewage farm to be used for irrigation. The chlorination tank will give a 20-minute detention period at maximum flow. Liquid chlorine, from apparatus located in the power house, will be fed into the inlet to the chlorination tank.

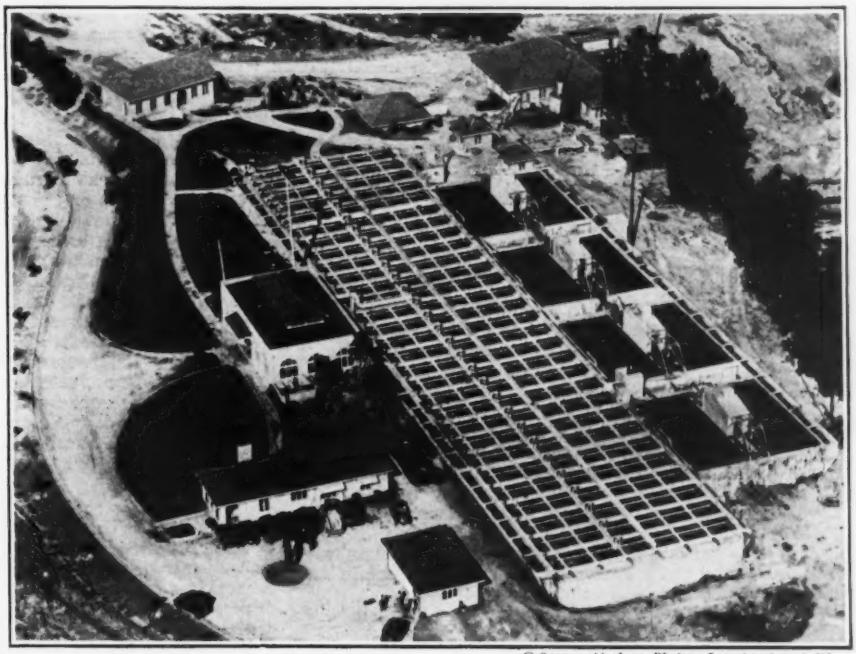
Sludge Re-aeration—A sludge re-aeration period of one hour is provided for in the sludge re-aeration tank, which is located between the power plant and the final settling tanks. This period was chosen, however, to insure a constant supply of sludge for the sludge pumps rather than for the purpose of conditioning the sludge itself, since it is anticipated that sufficient aeration will be obtained in the aeration tanks. Aeration in this case seems the most convenient method of preventing the sludge from settling and forming solid masses in the tank. The re-aeration tank is similar in cross section to the aeration tanks, but the width is less and there is only one row of aerator plates. The ratio of plate surface to total area is 1 to 13. The re-aeration tank is so connected that it can be used as a sump to drain the aerator tanks and the final settling tanks, since the condition of the stream will not permit untreated or partly treated sewage to be discharged. The contents of the tanks will be pumped back to the Imhoff tank through the return-sludge line.

Blowers—The power plant, laboratory, tool room and office will be housed in a substantial brick and concrete building, 35 ft. square, located adjacent to the sludge re-aeration tank. Space is provided for four blower units each with a capacity of 875 cu.ft. of free air per minute at 10 lb. pressure, or approximately ½ cu.ft. of air per gallon of sewage at the maximum rate of sewage flow, plus 20 per cent of the sewage in the form of returned sludge. Three units are to be installed at once, two of which will be driven by electric motors and the other by an automobile type gasoline engine. The engine-driven unit will be held in reserve for emergency use.

Sludge Pumps—Two centrifugal sludge pumps will be installed, one to be motor driven and the other (a stand-by unit) to be driven by an oil engine. Each of these pumps will have a capacity of 350 g.p.m., and space has been provided for a similar unit for future installation. The pumps will be located in a pump pit and will operate under negative head.

Power Required—It is estimated that 1 cu.ft. of air per gallon of sewage, based on maximum flow, will be required, which means that two of the blower units will be operated continuously and that one of the sludge pumps, the Dorr clarifiers and the pump on the air washer will also be operated continuously. This represents a power cost of $11.50 per million gallons of sewage treated.

Air Piping—The air piping will be of class A cast iron H and S pipe with the exception of the drop pipes to the plate containers, which will be of galvanized wrought iron. The air is to be drawn through a washer located at the inlet to the 12-in. suction pipe and will be forced by the blowers through the 12-in. header to the aeration tanks where the 12-in. pipe branches into two 8-in. laterals. Each group of four plate containers (36 plates) will be served by one 4-in. drop pipe. A Venturi meter will be placed between the blowers and the first connection to give accurate air measurement.



© Spence Airplane Photos, Los Angeles, Calif.

AIRPLANE VIEW OF ACTIVATED SLUDGE PLANT AT ALHAMBRA

Sludge Beds—Two sludge-drying areas each with two 40x60-ft. beds, will be provided, and will give approximately ½ sq.ft. of bed per capita.

Cost—The contract cost of the plant is as follows:

Blower equipment	$5,900
Clarifiers	9,995
Pumps	1,399
General contract, grading concrete work, machinery, installation, power house, and pipe work	94,357
Total	$111,651

The plant was designed and the construction work will be supervised by Black & Veatch, consulting engineers, Kansas City, Mo., and Los Angeles, California.

The present method of disposing of dewatered sludge is not quite satisfactory. To get data on the use of sludge-drying equipment, W. C. Earle, city engineer of Pasadena, recently visited a number of cities, notably Milwaukee, Wis., and Houston, Texas. Subsequent to this trip plans and specifications for sludge-drying equipment were prepared and it was stated that bids would be invited at an early date. With such equipment it is expected that the moisture content of the sludge can be reduced from 84 per cent, as it comes from the filters, to about 10 per cent, in which condition it should have considerable value as fertilizer and could be sold under a permit from the State Board of Health.

For Unity and Efficiency of State Health Work

Abstracts of State Sanitary Officials' Papers on Water Supply, Bathing Places, Camps, Milk and Shellfish

NINE committee reports dealing with the wide range of administrative work now being done by the sanitary engineering divisions of American state departments of health were presented at the Conference of State Sanitary Engineers at Buffalo, N. Y., June 5 and 7, already reported at some length in our News Section of June 10, 1926, p. 958. The nature and value of these reports is indicated in the following brief abstracts, to which are prefixed catch titles and the names and addresses of the chairmen of the committees. In most cases the chairman is engineer of a state health department.

Cross-Connections: C. M. Baker, Madison, Wis.—Adopted as a final report, including a resolution against permitting not only cross-connections but also auxiliary intakes, and bypasses at purification works, together with definitions of all three, and a program for the elimination of all three. The resolution, after whereases stating that cross-connections, etc., have caused many outbreaks of typhoid and other water-borne diseases, and that check valves and notifying the public of the temporary use of polluted water cannot be depended on for protection, reads:

"BE IT RESOLVED, that no physical connections should be permitted between any potable public water supplies either through cross-connections, auxiliary intakes or bypasses and other supplies except as follows:

"1. With another potable public water supply;

"2. With a potable supply which is regularly examined as to its quality by those in charge of the potable public water supply to which the connection is made.

"This prohibition to apply to all piping systems, either inside or outside of any building or buildings."

Of 31 states reporting, 10 prohibit all cross-connections, 6 prohibit new ones, 8 permit double check valves as protection and 7 have no definite control. As to auxiliary intakes, 12 states prohibit them, 12 permit them when protected by removing a section of pipe, 5 on condition that the state board of health is notified, and 2 of the 31 states did not report. Bypasses at purification plants are prohibited by 17 states, are permitted by 10 if there is protection by removal of a section of pipe, while 2 have no definite control and 2 did not answer.

The report contained a list of some 55 outbreaks due to cross-connections, etc., which resulted in 8,028 known cases and 226 known deaths from typhoid and 11,000 cases of dysentery. The report also included synopses of ten court decisions holding either a private water company or a city liable for damages caused by sickness due to the use of polluted water.

* * *

Sanitary Conservation of Streams: W. L. Stevenson, Harrisburg, Pa.—Conservation does not mean hoarding but rather the adoption of measures to make that which is conserved increasingly useful. The first and highest use of water resources is for public water supply. As streams are the natural drainage channels of the land, the second highest use of water, from the sanitary standpoint, is for the disposal of sewage and industrial wastes, treated, if needful and possible, to such a degree as is required to maintain the receiving body of water in a condition fit for its present and possible future use. The order of precedence for use is determined by local circumstances and may be for navigation, manufacturing, industry, power irrigation, agriculture, fishing or recreation. Control over water pollution should be a matter of co-operation between the state and municipal authorities, industries, other states and the federal government. One member of the committee, J. K. Hoskins, U. S. Public Health Service, believes that statutory provision should be made for co-operation between the states and between these and the federal government.

Water Supply and Purification: H. W. Streeter, United States Public Health Service, Cincinnati—The survey (by U.S.P.H.S.) of 17 municipal water filtration plants treating highly polluted Ohio River water indicates that the average fully equipped plant of modern design, operated efficiently under skilled supervision and treating a water similar in its general character to that of the Ohio River, should be able to produce a *chlorinated* effluent showing an average conformance to the revised Treasury Department B. Coli standard when the mean B. Coli-index of the raw water does not exceed approximately 5,000 per 100 c.c. The wide disparity between the indicated limits of raw water pollution permitting the delivery of unchlorinated and chlorinated effluents, respectively, meeting the treasury standards, affords striking evidence of the extent to which water filtration plants treating the more highly polluted waters are dependent, under present conditions, on the continuous and effective use of chlorine as an aid in bacteria removal.

* * *

Chlorination of Water Supplies: Abel Wolman, Baltimore, Md.—The problem of water chlorination is primarily one of determining, from operating data and supplementary experiments, under what conditions of loading the process either collapses or approaches the danger mark. The committee feels that quantitative data should be gathered and analyzed. As a contribution to that end the committee submits a memorandum, with data and comment, from H. W. Streeter, U. S. Public Health Service, Cincinnati, limited to 17 filter plants on the Ohio River. Similar data for other filter plants are desirable. The memorandum went into factors of safety and limiting yearly averages B. Coli index per 100 c.c. in chlorinated and unchlorinated filter effluents. Arrangements have been made for mimeographed copies of the report and memorandum for distribution in advance of the appearance of the proceedings of the conference. (Address Arthur P. Miller, care of U. S. Public Health Service, Washington, D. C.)

* * *

Bathing Places: Stephen DeM. Gage, Providence, R. I.—For six years committees of this conference and of the Sanitary Engineering Section of the American Public Health Association, practically identical in membership, have been working on the sanitary and safety problems of bathing places. In 1925 these committees were joined. It is hoped that the report, after further revision, will come up a year hence for adoption by both organizations. [The report is altogether too long and detailed (17 foolscap single-space pages) for satisfactory abstract. It deals with bathing beaches and swimming pools, going into vast detail on the latter. Replies to questionnaires and exchange of data and opinion on sanitation, safety against accidents, functional and structural design of swimming pools, and rules for their safe use both as regards dangers from infection and accident. Water supply including filtration, disinfection and renewal, light, heat, ventilation, toilet facilities, and numerous other matters are considered in detail.]

* * *

Camps: E. S. Tisdale, Charleston, W. Va.—In 35 states which gave information to the committee over 3,000 camps were inspected by state authorities in 1925. In many camps bad conditions of water supply and sewage disposal were found. California alone had 400 camps inspected in 1925; Maine, 700; New York, 369; Florida, 225. The practice of posting "approved camp" signs is increasing, as also the inspection and certification of roadside water supplies, and the posting of notices at the entrance to cities stating that the water supplies of the latter are safe. The U. S. Bureau of Public Roads has adopted a standard drinking water sign for use on federal aid highways. The committee recommends that the word "safe" be prefixed to "drinking water" on these particular signs, and that camp sanitation control be decentralized, the states to set up standards for local enforcement.

* * *

Sewage and Excreta from Residences: H. E. Miller, Raleigh, N. C.—In the case of sewage disposal from residences the problem is not merely one of design on a smaller scale in direct ratio. Effect of scale reduction on velocities must be considered. As between states, there must be variations in capacity of tanks, frequency of cleaning. Where water carriage is not available, indications are for a return to some humble sort of earth-pit privy, with attention centered on thorough ventilation of the superstructure.

Milk: C. A. Holmquist, Albany, N. Y.—Progress in the adoption of the uniform milk ordinance of the U. S. Public Health Service, as summarized by Leslie C. Frank, sanitary engineer, U.S.P.H.S., a member of the committee, has extended in three years to over 90 cities in ten states. These are all in the southern part of the country [where the Public Health Service work to promote the ordinance has been centered]. The benefits of the work may be summed up in the words, better milk and larger per capita consumption. In general, the standard ordinance has the support of the dairy industry of the ten states. [It should be understood that in many other states the milk supply has been under quite extensive state or local control for from a few to many years.]

* * *

Shellfish: H. P. Croft, Trenton, N. J.—Branches of public health work closely associated with engineering are involved in shellfish sanitation. These include surveys of sources of pollution, fresh and tidal water currents, water bottom topography, bacterial examinations of water and shellfish, and the construction, equipment and operation of water supply and excreta or sewage disposal plants for shucking and packing plants. The status of control in the twenty oyster producing states as exercised by their health or other departments and the activities of the U. S. Public Health Service, through its recently established office of Shellfish Sanitation, were reviewed.

Overcrossing Bridge Dismantled on Suspension Supports

By Charles J. Seibert
Rio de Janeiro, Brazil

An unusual method was used in dismantling a 60-ton double-track steel bridge that until recently spanned the tracks of the Estrada de Ferro Central do Brazil in the city of Rio de Janeiro. The railway is the main artery of Brazil and carries very heavy freight and passenger traffic, the latter so great that during the morning and evening rush hours hundreds of passengers ride on the roofs of the coaches and on the locomotive tenders. This fact, together with the short headway of the train, was a factor in coming to a decision as to the safest method of removing the overcrossing.

Some twenty years ago the crossing was constructed to eliminate a grade crossing of the railway and the street railway. As the railway traffic then was not heavy, the erectors spread the railway tracks and erected the bridge on falsework. Recently the use of the crossing was abandoned, and as the material of the bridge was required for use elsewhere its removal had to be undertaken. For this purpose, the writer worked out the scheme described herein and illustrated in the photographs: To suspend the bridge bodily by means of suspension cables, picking up the load by hangers to the floorbeams, and dismantling it piece by piece.

No suitable new cable could be found locally. Four 85-m. lengths of discarded haulage cable were finally obtained from the Santos-São Paulo Ry., and each of the two suspension cables was made of two of these ropes. Timber bents were erected as towers to support the cables, and four sets of triple A-frame anchors were constructed of flats and I-beam sections found in the scrap heap, with a 3-in. pin at the apex of each frame engaged by wrought-iron yokes connected by 1⅛-in. screws to the cast-iron cable sockets. These anchors were loaded each by 125 tons of girder rail. The ropes were socketed by a method exactly the same as that described on p. 506 of *Engineering News-Record*, March 25, 1926.

As the bridge was on a sharp skew, the elevation of the two sets of cables at the tower top could not be the same. One pair was passed over the cap of the tower and the other over a support lower down. The slopes of the cables between panel points had been worked out graphically for the known panel-point loading.

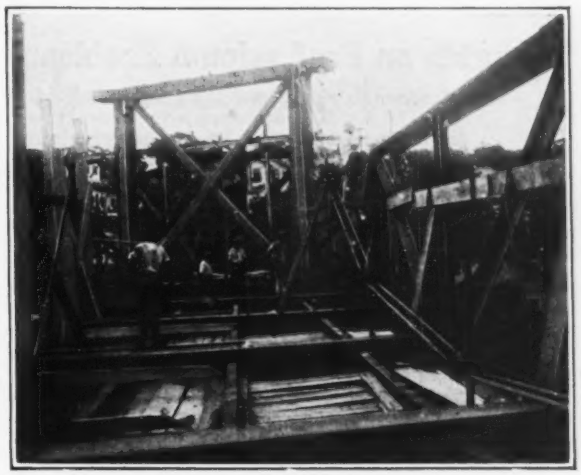


FIG. 1—BRIDGE SUSPENDED DURING DISMANTLING

Under the ends of the floorbeams longitudinals 14x14 hardwood timbers were placed, and the suspension screw shackles were attached to these. The timbers served as stiffening girders when the loads changed in the course of the removal of the bridge members.

It took about 30 days to build and rig the lifting tackles. On Dec. 22, 1925, the bridge was raised clear of its end pins, and it was then held there 24 hr., while observations were taken of the stability of the anchors against sliding. The suspension screws on either side of the center of the span up to the ends of the bridge were then slightly slackened off, to give the structure an upward camber. On Dec. 23 the cutting of rivets was started, and by Jan. 3 all steelwork had been taken down and stacked ready for shipment.

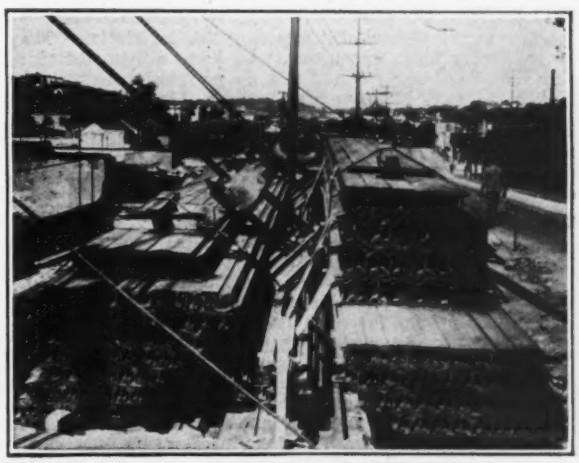


FIG. 2—SUSPENSION BACKSTAY ANCHORAGE

All the field work was supervised by Edward King, late captain of gas engineers in the British Army, using about 20 men wholly unaccustomed to this class of work. The clean-cut execution of the job was due largely to Captain King's ability to lead untrained men. No interruption of traffic occurred. Trains crowded to the roof passed under the bridge while members were being hauled ashore on a cableway rigged to the towers.

Thoughts on Professional Problems

Random Extracts from the Presidential Address of Dr. D. B. Steinman to the Convention at Philadelphia, June 18, of the American Association of Engineers: "Our Profession"

EVERY man is a debtor to his profession.

We want to make these words more than a mere phrase—we want to make them part of our working lives.

As we are benefiting by the profession's heritage from the great engineers who labored in the past, we want to augment that heritage before passing it on to those who are to follow us.

Our inheritance is two-fold: On the one hand, it consists of that vast store of scientific and technical knowledge that has been built up by past generations of scientists and engineers. That is our technical heritage.

On the other hand, our inheritance consists of the public standing, confidence, and esteem, that have been won for our profession by the engineers who labored before us. It consists of the high professional traditions they have handed down to us to cherish and foster. These things constitute our professional heritage.

In this era of international economic competition, the wages of labor are ultimately determined by the efficiency of production, and national prosperity may be measured by the purchasing power of the workers' earnings. The engineer has made possible the higher earnings, the shorter hours, and the higher purchasing power of the workers' wages—all things that constitute the foundation of our national prosperity. The community or nation that best develops and applies the brain power and inventive genius of the engineer will be the most prosperous.

The American Association of Engineers has been active in initiating and sponsoring legislation for the licensing or registration of engineers. More than half of the states now have such registration laws for professional engineers, and the Association, on behalf of the profession, is exerting its efforts to improve the effectiveness of those laws and to extend their enactment to the remaining states. It is through such laws and their vigilant enforcement that the public welfare and the good name of the profession can be protected from the practice of quacks and incompetents.

A few engineers are still opposing this legislation. They are generally older engineers, who have already attained their individual success and see no personal benefit to be derived from registration laws. They object to the slight inconvenience imposed. We must bring home to such men the selfishness of opposing a movement for the betterment of the profession merely because they have nothing personally to gain therefrom. It is the young engineer of today and the engineers of the future who will reap the full benefits of the licensing legislation.

In any vocation subject to conditions of economic pressure, there is a tendency for a certain amount of competitive commercialism to appear. For the sake of our profession, we must combat this competitive urge.

We must continue to combat such practices as mad scrambles for engineering engagements, trying to get work away from other engineers, taking part in fee-cutting competitions, undignified self-laudation, disparaging the character and ability of other engineers, or skimping services to increase profits. We must continue to resist all tendencies toward the commercialization of our profession.

From the viewpoint of the engineer who has arrived, there may be no cause for dissatisfaction with the returns from engineering as a calling. But for the ninety and nine per cent who have not reached a position of financial security and independence, the picture looks quite different. The general public does not know that the average professional engineer, notwithstanding his high investment of years and money in education and training, has to work for a salary lower than the wages of the average bricklayer, plasterer, or plumber.

It is estimated that over 80 per cent, perhaps 90 per cent, of all engineers are employees, working for wages; and only 10 or 20 per cent of all engineers are in independent private practice, working for professional fees. This established condition in the engineering profession is a natural consequence of the nature of engineering work; for that work generally involves large projects, requiring large organizations to handle them. We must face this established condition in the engineering profession, and we must strive to alleviate its effects.

Unemployment is unquestionably the most serious problem facing the individual engineer. Unemployment is an economic waste. By shortening the period of unemployment for the engineer out of work, the Association renders a real service to the economic welfare of the individual, the profession, and society.

The most effective and enduring contributions to individual welfare are to be attained through co-operative efforts for the advancement of the profession as a whole.

We have learned that we are building for the future.

Mexico Begins Irrigation Development on Large Scale

EIGHT proposed irrigation projects in Mexico are being investigated by parties of experienced reclamation engineers sent out by the J. G. White Engineering Corporation, acting for the Mexican government. This is the first step in a large development enterprise recently conceived by the government to increase the agricultural resources of the country and to provide land for prospective farm owners. The ultimate scope of this development, it is expected, will be considerably larger, covering possibly fifteen or twenty separate projects at a cost which may exceed thirty million dollars.

President Calles has made constructive agricultural reform one of the main objectives of his administration. Two important items on his program are the development of a road system and reclamation of arid land. For the latter purpose an item of twenty million pesos has been placed in the annual budget, against current revenue, and development is to proceed as rapidly as this fund will permit. The White company has been engaged to carry out the engineering and construction work on the project, subject to the approval and supervision of a government irrigation commission, consisting of Francisco A. Solido, Sanchez Mejorada, and Waldo Soberon.

The projects now under study are well distributed over the northern part of the country, as follows: One in Lower California, one (more strictly a group of three separate areas) in Chihuahua, two in Durango, one in Aguas Calientes, one in Michoacan, one in Tamaulipas, and one in Nueva Leon. The examination is to determine feasibility, cost and type of development. On the basis of the report, recommendations are to be made by the engineering corporation to the irrigation commission, upon whose approval detailed plans will be developed and construction undertaken. After completion of the projects, the irrigation commission will develop them into going farms and colonize them, finally turning these projects over to the Land Bank for administration.

Frank E. Weymouth, former chief engineer of the U. S. Reclamation Service, has been engaged by the J. G. White Engineering Corporation as chief engineer of its Mexican company, by which the work is being carried out. G. W. Caldwell is general manager of the company. The staff of the Mexican company includes a number of engineers long identified with the U. S. Reclamation Service, among them C. C. Fisher, C. W. Smith, F. L. Sellew, H. J. Gault, and John F. Richardson.

Engineering in the Small City

A series of notes from the field on the Problems and Practices of the Municipal Engineer in the Cities Below 100,000

The Editor Visits the City Engineer

Snapshots of Our Representative Small Cities

PIKE'S PEAK FROM COLORADO SPRINGS, COLO.

Colorado Springs, Colorado

COUNTY SEAT OF EL PASO COUNTY. Located on the east slope of the Rocky Mountain range at the foot of Pike's Peak, it has an elevation of 6,000 ft. above sea level. It is connected with Denver, 75 miles to the north, by two of the six railroads and the Mountain Parks Highway surfaced or paved all the way. Cripple Creek is 45 miles away. Chief all-year health resort in Colorado, it is supplied with its full quota of hospitals (1,106 beds) and hotels (2,850 rooms), the latter catering principally to the summer tourist. The Golden Cycle mill treats 265,000 tons of Cripple Creek ores per year, valued at $3,895,000. Manitou, Seven Falls, Garden of the Gods, The Cave of the Winds, the cog road and auto road to the top of Pike's Peak make the city a center for the summer tourist business. Colorado College is located here. Organized as a town in 1872. Pop. 36,000.

LAID out by an engineer, Colorado Springs shows in many of its physical features the hand of its originator. Gen. William J. Palmer, builder of the Denver & Rio Grande Ry., was the founder of the town and laid it out on broad, ample lines with wide streets and parkways and a rectangular major street plan that will not require any meddling by the modern city planner for many years to come. Located in an unexcelled situation on a high mesa 7 miles from the base of Pike's Peak and 3 miles from the Front Range the subdivided portion is about 1 mile wide east and west and 5 miles north and south along the east side of Monument Creek. Colorado City, recently annexed, occupies the narrow valley of Fountain Creek and extends northwest from the southern part of the main city. The city limits, however, cover a much larger area, some 3½ miles north and south and 2½ east and west for the main city. The original town had all streets 100 ft. wide, avenues 140 ft. wide and alleys 20 ft. but later additions have 60- and 80-ft. streets.

General Palmer laid out Colorado Springs for well-to-do people who wanted plenty of room and that class largely predominates to this day in the major portion of the residence district. In consequence there are no factories of note, smoke nuisance or large foreign element. Altogether the city is an ideal place to live if one has the means. The flivver tourist will find, however, plenty of cabin or tent quarters huddled together or perched on the side of the steep slopes in Colorado City. Serving this population with utilities is a problem for the engineers and the health board.

As the city proper is located so near the foothills, one is surprised at the comparative flatness of the topography which, however, does have plenty of slope to carry the irrigation water by the El Paso ditch throughout most of the city. The ditch intake is below Manitou, skirts the Fountain Valley above and through Colorado City, breaks over the mesa to the north part of the city under Monument Creek and serves the east slope of that creek for the valley lawns and parkways. Since the rainfall is scant, water is one essential that makes the city here possible. Things from the engineering standpoint revolve, as they do in all irrigated countries, around the water supply. Pike's Peak not only furnishes the lure for the tourist but water from its ever melting snows and wooded slopes supplies the region with its life-blood. Ample grades to the creeks simplify the sewerage system. As the underlying material is largely gravel or disintegrated granite, trenching is simple, done mostly by hand. Water is infrequent.

As the advent of the motor car has increased the vacation appeal of Colorado in the summer to the people of the states to the east, population figures must needs be predicated on whether one refers to the 36,000 who are permanent residents or include the tourists who tax the city's water, sewer and other utility facilities in the summer. The increment of growth in population (permanent) is estimated at about 1,000 per year.

Colorado Springs is a progressive town. In 1908 it changed its government from the councilmanic to the commission form. Five years ago, it changed to the council-manager plan, which conforms to type, except that there are nine instead of the usual five members, that the term of office is six years and that three councilmen are elected every two years. The manager appoints the city engineer, who is also building inspector. The present incumbent is Frank O. Ray. The appropriation for the engineering department is $15,000 annually and the engineer's salary is $4,200. He employs extra men for special improvements, charging the expense to the assessment districts, but regularly employs an inspector at $1,800, a draftsman at $1,800, instrument man at $2,400, one rodman and one chainman at $1,500 each, and another at $1,380. Salaries are low through competition of people who cannot live elsewhere.

Mr. Ray handles the engineering of permanent improvements for all departments and the erection of new buildings. Operation and maintenance of the water, electrical, park, street and health departments are each under a separate head, all reporting to the city manager, A. M. Wilson. Each of these departments calls on the engineering department for service as needed. For special problems the city officials believe in employing expert consulting advice. The late George G. Anderson made repeated reports on the intricate water supply and hydro-electric problems. Talented men have been employed on the park system which is extensive and requires expert maintenance. The gift from General Palmer of 1,500 acres in 1907 comprised completed parks, boulevards, broad roads and trails in the city, over the mesa and into the adjacent mountains. The principal feature is the 164-acre narrow Monument Valley Park paralleling for 2 miles the main portion of the city formerly an unsightly stretch. The channel was corrected with easy curves, the banks riprapped, giving a uniform width of 60 ft. and depth of 10 to 12 ft. Maintenance of the 2,512-acre park system costs about $1.80 per capita.

Paving—The area of the city is 9.21 sq. miles and in it there are 143 miles of streets of which only 13 miles are paved. This mileage covers the main arteries. In the business district the streets are paved for 40 to 70 ft. and in the residence district for 30 to 60 ft. wide. Avenues in the business district are paved to a width of 100 ft. In the residence district the streets have two 35-ft. or 30-ft. driveways and a center parking strip. The types and yardage of streets and alleys are: Sheet asphalt on concrete base, 90,000 yd.; asphaltic concrete, 360,300; asphalt macadam, 5,700; concrete on streets with car tracks, 36,880; concrete in alleys, 17,350 yd. The alley paving and 100,000 yd. of asphaltic concrete was done by the city with its own plant and labor. It consists of a 2-in. Topeka mix top on a 5-in. concrete base and costs $2.25 per yd. About 260,000 yd. of the asphaltic concrete and the concrete paving of the car tracks was done by the street railway company at cost, with a maximum stated in the contract and a provision giving the city the equipment should the work, including the equipment, be less than the maximum set. As the cost was considerably less, the city acquired the $90,000 plant.

For all paving, except sheet asphalt and alley paving laid in the business district, the city has paid one-half the cost by means of general obligation bonds issued by vote of the people. The one-half paid by the property owner is assessed by the zone method, using five zones, taking successively 16/31, 8/31, 4/31, 2/31 and 1/31.

Curbs average 8 in. high but vary from 7½ to 10 in. where the grade is flat. The face of the curb is battered ½ in. and cut every 10 ft. Gutter slabs are 6 in. thick and 30 in. wide. For 3 miles along Nevada Ave., one of the main north and south streets, a 12-in. tile irrigation line is laid back of the curb with the top 18 in. below the curb. Every 50 ft. tees are placed upright in the line with their tops 3 in. below the curb and connections are carried under the sidewalk to irrigate private lawns. The parkways and lawns are graded 3 in. below the curb so that a 3-in. irrigation may be given. This is done about twice a week. On other streets a concrete flume 30 in. wide and 12 in. deep back of the curb is used instead of the pipe line but is not so desirable. Crosswalks must bridge the ditch, which is dangerous for small children and unsightly.

In maintaining the streets, which includes cleaning the paved 13 miles and sprinkling the balance, nine trucks, two tractors and an average force of 50 men are employed. A fully-equipped machine shop has been installed where all city vehicles and equipment are repaired by expert mechanics.

Throughout the city where curb and gutter have been installed the names of the streets are stenciled on the curb. This practice was started in 1924. Some of the signs painted two years ago are still in good condition.

Sewers—The city has 10.3 miles of storm sewers and 88.7 miles of sanitary sewers. The minimum grade is 0.4 per cent but 80 per cent have grades of 1 per cent or more. The total first cost of the sanitary sewers is paid for by the city and all repairs and ordinary extensions are paid out of the general fund. Both vitrified and cement tile are used. The total cost of storm sewers is assessed against the lots in the district.

The sewage contains no trade wastes. The sewage is discharged, without treatment, at a single point below the city into Fountain Creek. The sewerage system serves about 30,000 people and is operated by a superintendent and two men who clean and repair the sewers. The average flow is 6.5 m.g.d. and the maximum 7 m.g.d.

Engineering Work

Water—Water and hydro-electric power must be treated together since the city operates a combined system, having taken over the plant of the Colorado Springs Light, Heat & Power Co., July 1, 1925. Built 25 years ago, this is one of the first high-head (2,400-ft.) plants in the country. George W. Jackson, of Chicago, who built the famous Strickler tunnel, was given a 25-year franchise at the end of which the plant was to be turned over to the city without cost. The city got it last year. After looking at the 1,000 lb. on the pressure gage and hearing the roar of the nozzles one examines the double-riveted 20-in. penstock with awe. The hydro plant is entirely inadequate for the city's needs and a new 5,000-kw. steam plant with all of the modern appliances only recently went into service, as well as another 1,000-kw. hydro plant at Ruxton Park, three miles above Manitou at an elevation of 9,050 ft. above sea level. It operates under 1,161-ft. head and is automatically controlled. The water leaving the plant enters the intake of the old 2,250-kw. plant at Manitou. The city furnishes electricity to suburban districts, Manitou and Fountain and the street railway, about 55,000 people plus 10,000 tourists in the summer.

Mr. Anderson, in his 1922 report on power possibilities, laid out six stages in the development of the combined water and hydro system. This year the officials are finishing up the first stage, one part of which is a 100-ft. intake dam on south Ruxton Creek. It is expensive to get cement into the site and finished concrete costs $35 to $40 per yd. Stone faced with gunite will probably be used.

The water supply comes by gravity from the southern slope of Pike's Peak. Three of the watersheds contain storage reservoirs. Water is delivered through supply lines to three distribution reservoirs, from which the city is supplied by gravity in two services.

The 30 square miles of watershed are patrolled by three watchmen who measure stream flow and report water levels daily. One of the most complete records of rainfall and snowfall on mountain slopes has been maintained for the past 16 years. Precipitation near the center of the watersheds varies from 19.49 to 33.46 in. and averages 25.37 in. Undeveloped watersheds on the north slope of 17 square miles have been acquired.

The water-works is managed by a superintendent, P. B. McReynolds, appointed by the city manager, with the engineering work done by the city engineer. The superintendent has 23 regular employees, including three watchmen in the mountains, a chief clerk and two assistants. The water department receives 1½c. per 1,000 gal. from the electric department for the use of the water through the wheels. This is equivalent to 0.3c. per kw. at the steam plant.

Mr. McReynolds' chief pride lies in the fact that the city has been granted by Congress large tracts in the forest preserves on both the north and south slopes of Pike's Peak for future development of supplies. What this means may be judged from the current cost of

Of the Small City

mountain water which runs about $300 per acre-foot for storage alone. It is for this reason that the city-owned irrigation ditch system has been developed for parks, golf courses and some lawns, all in accordance with the urgent recommendations of Mr. Anderson.

Two pressure systems are maintained, 60 to 80 lb. and 120 to 150 lb. Cast iron is used for distribution but steel pipe has been used for 30 years for supply lines and is still in good shape. It lasts best exposed but as it is laid mostly in a rocky bed with no adobe or alkali Mr. McReynolds gives it an indefinite life. Mathieson joints are used mostly, except in the higher elevations where some riveted butt joints are used.

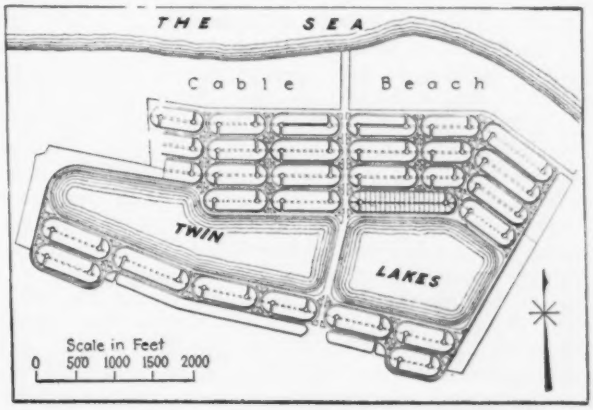
The health department, which examines the water daily, reports no evidence of contamination except from some of the non-impounded streams which drain the lower portions of the watershed and this is confined to high-water periods. In 1924 the health officials recommended three measures: Impounding for 30 days, discarding the lower waters or chlorination. Since all the water available was needed chlorination was resorted to by the Williams electrolytic method. In 1925 the upper water showed B. Coli on 8 days only, while in 1924 it showed on 25 days; in consequence no chlorine was applied. Repeated indications of contamination on the two lower streams for about six weeks were combatted successfully by continual dosage.

Only 30 per cent of the water is metered. All consumers are on a flat-rate basis except such places as laundries, apartments and taps in the business district larger than 1 in. The meter rate is 15c. maximum and 8c. minimum. The flat rate for a 50-ft. lot with one bath and toilet and one outside connection is $15 per year. About $193,000 or $4 per capita annually is collected. In 15 years, $900,000 in bonds has been paid off. There is now $1,072,000 indebtedness, the sinking fund for which is being cared for out of revenue, leaving a $35,000 annual surplus. The consumer owns and his plumber lays the service to the main but the department makes the tap. In case of leaks the department excavates and then notifies the owner to make repairs. Leaks usually show quickly. Lead pipe is used, with flanged connections to wrought-iron pipe under paving. A little electrolysis has been indicated by the spasmodic surveys. On this account Mr. McReynolds welcomes the replacement of street cars by buses which is rapidly taking place. Consumption is 180 gal. per capita with a 10-m.g.d. maximum in June, July and August, at which time there are restrictions.

An engineer would say that Colorado Springs is well run. Its city manager is a retired business man who knows and loves his town. The city engineer has his work well in hand. Of the water superintendent, the late Mr. Anderson stated in one of his reports on water supply that the city is more fortunate than it realizes in retaining that official. What is even better, coming from Mr. Anderson, is the statement that he "merits in a singular degree the confidence and support of the citizens and more material recognition of the value of his services." The superintendent of the electrical department, E. L. Mosley, is giving the citizens electrical service with fewer complaints than were received under company control.

Curved Street Intersections For Suburb

THE Twin Lakes Addition at Nassau, Bahamas, B. W. I., being developed by the W. E. Brown Land Co., Ltd., is laid out entirely with curved street intersections. This type of intersection used in suburban planning has been described in *Engineering News-Record* in several articles and letters, as Shorewood, suburb of Milwaukee, Wis., Oct. 9, 1924, p. 599; Terre Town, subdivision Terre Haute, Ind., Nov. 13, 1924, p. 804; and Warrendale Addition at St. Paul, Minn., Dec. 18, 1924, p. 1008.



NASSAU, BAHAMAS, CURVED STREET DEVELOPMENT

At Twin Lakes the streets including sidewalks are 50 ft. wide with a 100-ft. avenue through the middle of the community. At each intersection there are four islands covering least used portions of the crossing.

The end of each block is a semicircle in shape with 130- to 140-ft. radius divided into four sector lots. Rear entrance is provided by a 10-ft. roadway terminating with a 50-ft. circle at the center of the semicircle. The rectangular lots in the middle of the block are 60 ft. wide without a rear alley. Replacing this alley is a 10-ft. strip of land reserved for pipes and wires, so that, except for the crossing between blocks, no streets need ever be torn up for pipes or disfigured with wires.

Santa Barbara's Sewage Screening Plant

With the recent completion of the new 42-in. outfall sewer extending 3,214 ft. into the Pacific Ocean, Santa Barbara, Calif., put in operation a sewage pumping and screening plant with capacity sufficient for some time to come. The entire sewage flow of about 3 m.g.d. discharges into a sump on the beach from which it is lifted to two Dorr screens with a capacity of 6 m.g.d. each, only one of which is now required. There are two electrically driven pumps (10- and 12-in.) for regular service and an emergency 12-in. pump driven by a 60-hp. gasoline engine. The 10-in. pump is sufficient for the present flow. The screenings (now 18 cu.ft. per m.g.) are delivered to a pit by compressed-air ejectors and covered with earth but incineration may be adopted later. The effluent is discharged into the ocean in water 45 ft. deep. A representative of this journal recently visited a barge anchored directly over the end of the outfall while an unscreened sewage flow estimated at 3 m.g.d. was being discharged. There was then no discoloration of the ocean or visible indication of sewage.

Steel Study Prominent at A.S.T.M. Meeting

New Developments in Endurance of Steel—Study of Alkali Embrittlement —Final Report on Effect of Sulphur on Rivet Steel—Meeting Votes to Raise Strength Required for Cement—Talbot Delivers First Marburg Lecture

DEVELOPMENTS in steel were prominent among the proceedings of the American Society for Testing Materials at its annual meeting held last week in Atlantic City. Three papers, dealing with the very active subject of fatigue endurance, threw new light on the facts of this little understood action, and in part also contributed new problems to be studied. An investigation of the embrittlement of boiler steel by the combination of high stress in the metal and attack by concentrated alkali gave the results of long continued study at the University of Illinois. Data on the plastic flow of steel were reported from the Bureau of Standards. These, together with a number of other important items in the field of steel and of other metals, gave this year's meeting more of its old-time metals aspect than it has possessed for some years.

Raising of the strength requirements for portland cement, which was accomplished by the cement committee supported by the vote of the meeting, has been clearly foreshadowed for some time and therefore was taken rather as a matter of course. Marked activity in the field of some special materials—for example, in paint, where real progress was shown, and rosin, dealt with in twelve papers forming a special symposium—held the close interest of the special groups concerned.

Research is carried on actively by a number of committees, particularly by those concerned with corrosion (of iron and steel, of metal-coated iron, of wire screen cloth, and of non-ferrous metals), as was noted two months ago in our report of the proceedings of the Providence committee meetings of the society. Progress is also being made in the study of the magnetic analysis of iron, though the results in this field continue to have scientific rather than practical interest.

Talbot's Edgar Marburg Lecture—In the first Edgar Marburg lecture delivered since its institution last year, Prof. Arthur N. Talbot reviewed the development of knowledge through tests and experimental study in the field of reinforced concrete in this country. He sketched the virtual absence of scientific knowledge of reinforced concrete in the United States at the beginning of the present century, as contrasted with the considerable development of the subject in Europe beginning with the early practice of Coignet and Monier, the studies of Hyatt and Wayss, and others. Following this, he presented in graphic terms a statement of the multitude of questions confronting the Joint Committee on Concrete and Reinforced Concrete when it was organized in 1904. To quote:

> The Joint Committee on Concrete and Reinforced Concrete when it was organized in 1904 was confronted by questions on which there was then but little authentic experimental information. In beams, attention had to be given to the permissible working stresses in reinforcing bars for different kinds of structures and different forms and qualities of bars, and to whether the tensile strength of the concrete might be utilized for the resisting moment of the beam. What working stress in compression may be allowed in the concrete, or better, what percentage of reinforcement for the given working stress in tension is permissible? How may requirements for the quality of concrete be set forth? How does this material resist web stresses, and how shall the web stresses be calculated, and what allowance shall be made for the various forms of web reinforcement—a most difficult and vexing question. How does a bar develop bond resistance; how much resistance is available and in what way does it depend upon form and size? What are the conditions of stiffness and elasticity in this material and how do these conditions affect a member or frame? From this knowledge what values of positive and negative bending moment shall be specified under the varied circumstances existing in buildings and other structures? How do the loads of floors distribute themselves to and along the beams and girders? How do columns act under load and what is their strength when reinforced in various ways? What is the effect of spiral reinforcement, both on the ultimate strength and on the useful strength of the column, and what of the combination of longitudinal and spiral reinforcement? Must columns resist bending put into them by the floor system and in what way and to what extent will the several kinds of columns develop such resistances? How do footings act and how may they be designed? Has the flat slab a mysterious and wonderful strength that baffles analysis? What information should be made available to determine what specification may best be made for concrete itself—especially with present-day methods of transport, placing and tamping? In details of construction, how closely without injury to the member may bars be placed both among themselves and to the sides of the member, and what provision shall be made for forms and bracing and falsework? All these and many other questions the Committee found needed answering. All needed tests, real experiments, facts on which to base engineering analysis and engineering judgment.

The significant subjects and items of research which grew out of this unexplored condition of the field were then reviewed in brief summary. Finally, Prof. Talbot sketched some of the main results of a new study of concrete in compression carried out at Illinois and dwelt upon the desirability of research in cement.

New Instruments—Several new testing devices and instruments were described. Two of these are shown by the cuts reproduced here in Figs. 1 and 2—a highly sensitive and at the same time robust type of mirror extensometer developed by Prof. M. F. Sayre, of Union College, Schenectady, and a twist meter for torsion test, constructed by Prof. J. H. Smith, of the University of Pittsburgh. The former measures to 0.000004 in.

Fatigue and Endurance Phenomena—Three papers brought out new data on fatigue and endurance, the authors being D. J. McAdam, Jr., reporting the most recent work done by him at the Naval Engineering Experiment Station, Annapolis; P. L. Irwin, of the Westinghouse Electric & Mfg. Co.; and R. R. Moore, of the McCook Field Laboratory of the Army air service.

Mr. Irwin had reported last year on endurance under cyclic reversal of direct stress, carried out with an ingenious electromagnet stressing device, and had shown that the endurance limit in such direct stress was substantially identical with the flexural endurance limit found in the usual rotating-beam tests. That conclusion, however, was restricted to materials of high proportional limit—higher than the endurance limit. During the past year similar tests made on materials with proportional limit lower than the endurance limit (electrolytic copper, monel metal, and nickel, all of them be-

ing annealed) establish that here also the direct-stress endurance limit—the stress at which the material resists indefinitely—is the same as the flexural endurance limit, thus:

	Flexural Endurance Limit (cantilever)	Direct-Stress Endurance Limit	Proportional Limit	Ultimate Strength
Copper (annealed).....	10,100	11,000	1,875	31,200
Nickel (annealed).....	38,000	41,500	16,000	82,750
Monel (annealed).....	40,000	40,000	14,000	90,600

At McCook Field weakening of endurance strength by screw threads and by single circumferential grooves was studied, to throw light on propeller hub failures. It was found that a specimen with a continuous thread is much stronger in endurance than a specimen with a single circumferential groove; that the endurance strength increases as the radius of the bottom of the groove is increased; and that it is lowered as the depth of the groove is increased. The relations differ from those found in static strength tests, where a groove as well as a thread makes the specimen stronger (referred to the root area). One important conclusion reached is that the endurance-weakening effect of a thread must be studied by tests on threads and not by tests on single grooves. A few auxiliary endurance tests were made on specimens that had first been subjected to the corroding action of salt spray; although the corrosion pits were less than 0.002 in. deep, the endurance strength was lowered by 21 per cent.

Corrosion in its effect on endurance was one of the main subjects of tests at the Annapolis station during the past year. Significant results were reported. Briefly, corrosive action going on simultaneous with fatigue-stress alternation was found to lower the endurance very greatly. Various alloy steels and irons tested in a stream of water showed reduction of the endurance limit by as much as one-third in some cases, the effect increasing with the hardness of the material. Microscopic examination revealed the formation of pits on the surface of the metal, through which transverse cracks extended. When the water action was applied before (but not during) the alternating-stress test, the weakening effect was less: "The effect of rather severe corrosion prior to fatigue is much less than the effect of very slight corrosion simultaneous with fatigue."

In other tests, without corrosion, Mr. McAdam extended the loading in the alternating-stress machine to amounts producing very high nominal stresses (i.e. stresses computed by the ordinary bending formula), even well above the tensile strength of the material. The results arranged themselves in smooth continuations of the normal stress-cycle graph obtained at lower loadings.

Alkali Corrosion of Boilers—Corrosion effects formed the central feature also of a paper by Prof. S. W. Parr and F. G. Straub, "The Cause and Prevention of Embrittlement of Boiler Plate." Long studies have been made by them at the University of Illinois to determine the nature of the action which makes certain boilers brittle and has led to many boiler failures. They find caustic soda in the boiler water to be responsible; it sets up a severe intercrystalline corrosion leading to the development of cracks and extensive loss of ductility of the metal. The phenomenon has been under study for more than ten years. Well waters in some regions of the Middle West and Southwest are responsible, and the alkali-producing effect of water softening treatment is involved in many cases.

Cast-Iron Pipe Tests—Failure tests of 6-in. cast-iron pipe obtained from foundries using different casting methods (green sand, dry sand and centrifugal) were reported by Professors Arthur N. Talbot and Frank E. Richart, University of Illinois. About 300 pipes were tested, under impact, internal pressure, and flexure, and test pieces cut from the pipe were also tested. Marked differences in manner of failure were found, and the comparison of different pipe-casting methods by the test results did not prove to be the same for all of the test methods used. A very high degree of uniformity of results was secured. In general, test bars (separately cast) and test strips cut from the pipe developed a bending strength somewhat more than double the bursting strength of the pipe; tensile tests of specimens cut from the pipe gave about 50 per cent more than the bursting strength of the pipe. The bursting strength of the pipe ranged from 14,000 to 24,000 lb. per square inch stress in the metal, while the modulus of rupture in the bending tests of the whole pipe ranged from 28,000 to 39,000.

Fig. 1

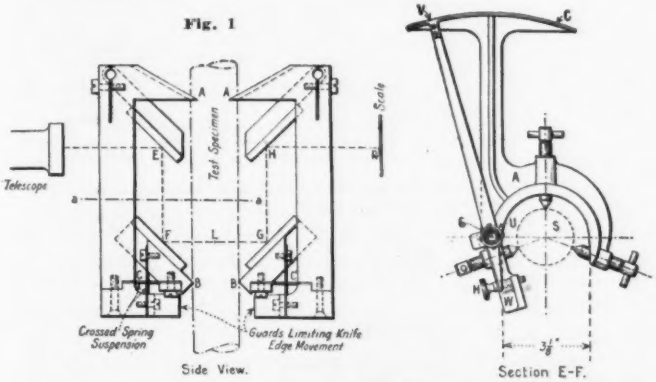
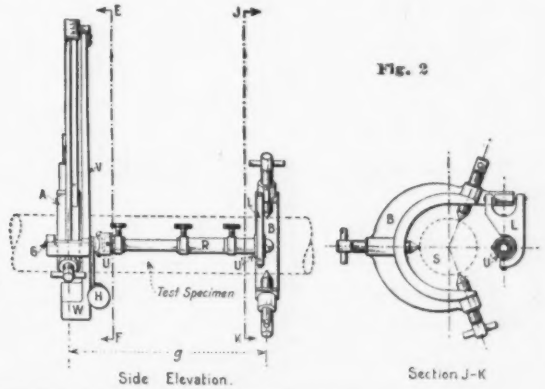


Fig. 2

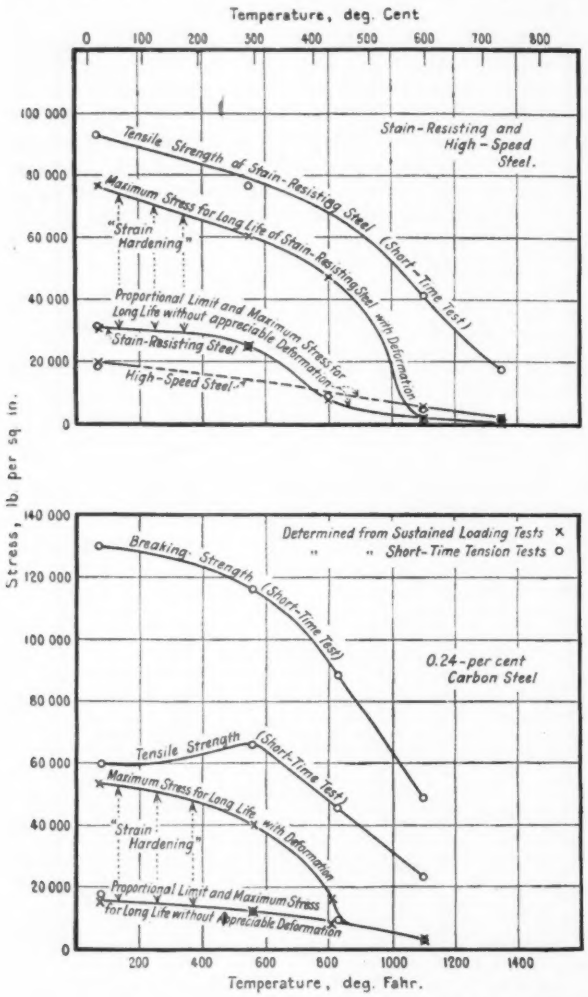


FIGS. 1 AND 2—TWO NEW INSTRUMENTS BROUGHT OUT AT A.S.T.M. MEETING

Fig. 1—Compound Mirror Extensometer, designed by Prof. M. F. Sayre, Union College, Schenectady, N. Y. For high-precision work; readings to a precision of 0.000002 to 0.00002 are possible. In this extensometer, which is shown at the left in the cut, two fixed mirrors E and H and two tilting mirrors F and G, reflect to scale for reading by the telescope. The gage points are A, A (fixed) and B, B (part of the tilting mirrors). Mirrors F and G are supported by crossed-spring suspension.

Fig. 2—Twist meter for torsion tests, designed by Prof. J. H. Smith, University of Pittsburgh. Two clamp frames A and B on the shaft or test piece are connected by torsion rod R, fitted with universal joints near its ends. It turns the pointer V along the gradated arc C attached to frame A.

Flow of Steel—New tests on continuous deformation of steel under constant load were reported by H. J. French, of the Bureau of Standards, in "Methods of Test in Relation to Flow in Steels at Various Temperatures." He worked with structural steel of 0.24 C., high-chromium stain-resisting steel, and tungsten- vanadium high-speed steel, at temperatures ranging from


Temperature, deg. Cent
0 100 200 300 400 500 600 700 800
100 000
80 000
60 000
40 000
20 000
0
Stain-Resisting and High-Speed Steel.
Tensile Strength of Stain-Resisting Steel (Short-Time Test)
Maximum Stress for Long Life of Stain-Resisting Steel with Deformation
"Strain Hardening"
Proportional Limit and Maximum Stress for Long Life without appreciable Deformation
Stain-Resisting Steel
High-Speed Steel
Stress, lb per sq. in.
140 000
120 000
100 000
80 000
60 000
40 000
20 000
0
Determined from Sustained Loading Tests ×
" " Short-Time Tension Tests ○
Breaking Strength (Short-Time Test)
0.24-per cent Carbon Steel
Tensile Strength (Short-Time Test)
Maximum Stress for Long Life with Deformation
"Strain Hardening"
Proportional Limit and Maximum Stress for Long Life without Appreciable Deformation
200 400 600 800 1000 1200 1400
Temperature, deg. Fahr.

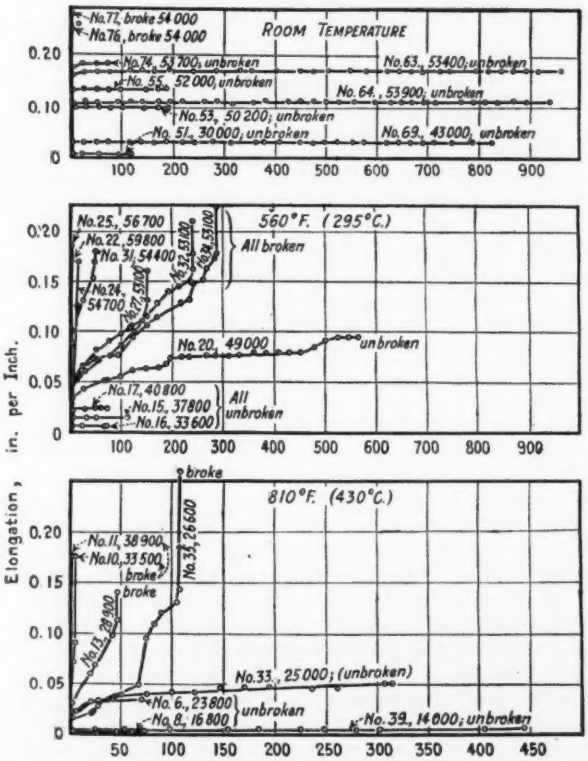


FIG. 3—FLOW OF STEEL UNDER SUSTAINED LOADS.

At left, flow-time curves of 0.24 carbon steer at various temperatures

At right, stress results deduced from flow tests on low-carbon,, stain-resisting and high-speed steels.

normal to 1,350 deg. F. (730 deg. C.). A highly sensitive extensometer of the Martens mirror type with the prisms and autocollimator devised by Tuckerman permitted stretch readings as fine as 0.000004 in. The results support the inference drawn from previous tests, that the long-life load is approximated by the short-time proportional limit determined at the same temperature. Further, when stress is plotted against log of life for any given metal and temperature, curves are obtained very similar to the semi-logarithmic stress-cycle curves of repeated-stress endurance tests.

Strength of Welded Joints—J. R. Dawson, reporting various series of tests of oxyacetylene welded joints, brought out the uniformity of results that can be obtained. In one case, the same operator welded a butt joint in a plate each day throughout a month, and tensile tests on three strips cut from each plate were compared (see diagram reproduced in Fig. 4 herewith, showing variations no greater than would be obtained in tensile tests of a uniform lot of steel. In another case, 63 different welders each welded the same type of joint in ⅜-in. fire-box steel, with the result that the general average tensile strength was 52,800; two out of the 63 fell between 35,000 and 40,000, while 50 fell between 50,000 and 60,000 lb. per square inch. Similar tests, some made with ordinary low-carbon welding rod and others made with a special welding rod high in manganese and silicon, showed that with the latter all welders obtained joints stronger by from 5,000 to 10,000 lb., the relative improvement for the poor welders being therefore several times as great as that for the good welders. Prof. H. F. Moore pointed out in discussion that many excellently welded joints, having very good static strength and ductility, show a low fatigue strength, which may affect the use of such joints in reversed-stress repetitive service.

High Temperature Strength of Columns—Tests of structural steel and cast-iron shapes at elevated temperatures (up to 1,750 deg. F.) were reported by S. H. Ingberg and P. D. Sale. The principal results are represented by the diagram Fig. 5. A rather more rapid weakening was shown for the thin-metal sections than for the thicker.

Corrosion-Resistant Steel in Structural Work—T. H. Nelson, in "Recent Developments in the Use and Fabrication of Corrosion-Resistant Alloys," told of a very large-scale application of chromium low carbon steel for tank construction and other structural work in a chemical plant. Experience with rivets indicated that there is a tendency for the edge of the hole under the

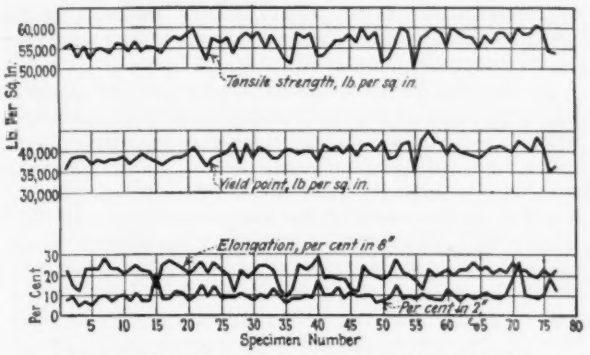


FIG. 4—UNIFORMITY OF AUTOGENOUS WELDS
Tensile test results on oxacetylene welded double-V joints in ½-in. firebox steel; each welded plate was cut into three test strips (1, 2, 3; 4, 5, 6; etc.)

shop head to cut into the head, resulting in weakness unless the hole is countersunk and the rivet filleted. F. N. Speller, of the National Tube Co., remarked that men of the oil industry have declared they will be interested in stain-resisting steel when its price gets down to the neighborhood of 40c. per pound.

Concrete and Cement Papers—Individual papers on the subjects of concrete and cement were less numerous than usual. The only one on cement was a scholarly address by Dr. R. H. Bogue on Portland Cement Research. Dr. Bogue is in charge of the fellowship study being made at the United States Bureau of Standards with the co-operation of the Portland Cement Association, and his paper, primarily a defense of pure science as an aid to engineering and engineering research, was generally descriptive of the work in cement now being done at the Bureau of Standards. Some years will be required before enough has been done there to indicate whether there is promise of practical effect on the manufacture and quality of portland cement, but the work is well under way and the results promising.

At the request of Committee C-9, on Concrete and Concrete Aggregates, C. M. Chapman, the chairman of that committee, presented a paper entitled "Concrete Specification Problems." According to its own preface, the paper discussed the subjects to be covered in a comprehensive specification, the necessity for separate specifications for concrete for different types of service, the possibility of developing special cement for particular service and the necessity for the development of test methods for determining the suitability of fine and coarse aggregate and water for making concrete for different uses. It described the various methods for designing concrete mixtures, with a suggested adaptation of the present specifications of the Joint Committee to include the use of the water-cement ratio method for design and for control. The paper is an excellent exposition of some of the difficulties involving the writing of concrete specifications due to the areas of lack of knowledge or of confused knowledge.

In the matter of concrete and cement testing, there were two papers—one by S. R. Mitchell, Riverside Portland Cement Co., which suggested an interchange of testing operators between different laboratories and co-operative checking of the cement testing among laboratories in the same locality in order to reduce the variation in testing results, and the other by W. F. Purrington and James McCormick (New Hampshire State Highway Department) which described a cast-iron cup with a sand bed used to cap concrete test cylinders. This method showed concordant results, but with lower variation than by the testing by the standard method.

In "Concrete Quality," H. K. Gilkey (University of Colorado) described the autogenous healing of concretes and mortars observed in concrete test cylinders which had just failed under load and had been retested at some later date. This phenomenon of the resetting of concrete across cracks has been checked in practice as noted in the American Concrete Institute meeting last February. Professor Gilkey's tests show that the recovery of strength is more complete at early ages and that cracks do not entirely disappear but certain deposits appear in them which seem to bind the separated masses.

Dean A. N. Johnson, University of Maryland, described a series of tests of 144 specimens of mortar and concrete in both tension and compression, the areas of the tension and compressive specimens being about the same, that is, about 16 sq.in. The object of the tests was to compare the ratio of strength in tension to the strength in compression. It was found to be constant for all mortars in concretes tested after a period of about 90 days, the value of the ratio being 0.08. For mortars and concretes less than 90 days old, the ratio

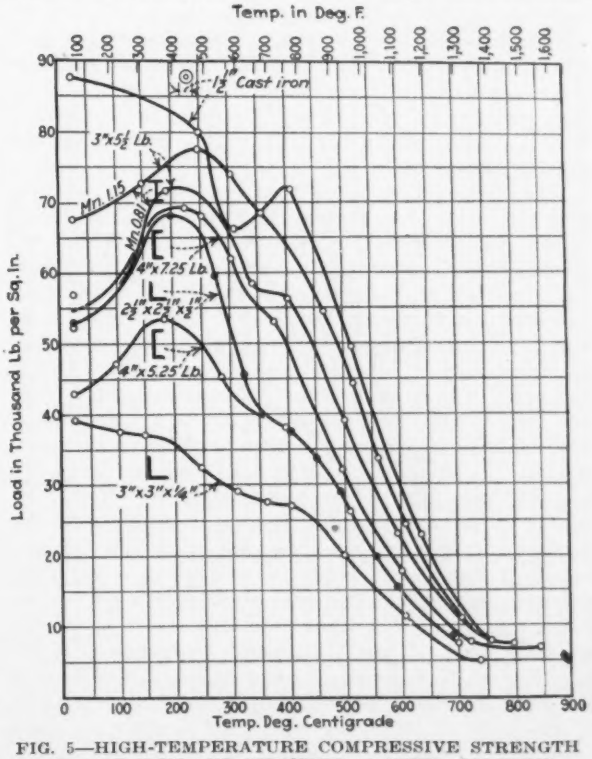


FIG. 5—HIGH-TEMPERATURE COMPRESSIVE STRENGTH OF CAST IRON AND STRUCTURAL STEEL COLUMNS

was practically the same for the mortar and concrete, but varied with the age from 0.15 to 0.08. This was one of the few tests that have been made on concrete in tension. In the discussion some tests that are now under way in the United States Bureau of Public Roads were reported.

Paving Papers—Two papers on paving matters were presented. F. H. Jackson (Bureau of Public Roads) described some tests that the government has been making on the effect of size of paving brick on rattler loss. The

size of brick has for some time been observed to have a bearing on the loss in the rattler. The tests were made on five sizes of brick to determine if anything of this sort could be discovered. It was found that the smaller sizes had the most loss but not in proportion to the weight. Question was therefore raised as to relative quality of the different sizes and it was discovered by other tests that the quality was not precisely uniform.

Prevost Hubbard and F. C. Field (Asphalt Association) continued the studies that they have been making for some years on a stability test of asphalt. This year they read a paper entitled "A Study of Certain Factors Affecting the Stability of Asphalt Paving Mixtures." Stability as measured by the shear test apparatus they have developed varies with the percentage of filler and with the various percentages of asphalt and there is a discoverable relation between the stability and the mixture at various temperatures. The value of the latest information obtained is that there appears to be a possibility of discovering the stability of various asphalt mixtures at different temperatures and therefore permitting a closer design for particular localities where temperature variations are known. H. L. Howe (Rochester City Testing Laboratory) commended the paper and stated that certain investigations that his laboratory had made checked up the results of the authors. A. W. Smith (Dow & Smith, consulting engineers) commended the work that Messrs. Hubbard and Field are doing in their new tests and said that while they have not yet reached absolute facts, they had established a gage where stability of an asphalt mixture may be measured.

New Cement Specification—A new standard specification for cement was adopted to be sent to letter ballot; it will be canvassed in August and if accepted will become the standard of the American Society for Testing Materials at that time. Committee C-1, on Cement, prepared the new specification and submitted it to the meeting for immediate adoption as standard rather than as a tentative. To have it accepted as such, it had to be approved by nine-tenths of those voting at the meeting. As it happened, the approval was granted unanimously. The committee has been working on the specification for about 18 months, and has arrived at its present form after a great deal of labor. It was reported to the meeting that it was extremely desirable to have the specification if adopted at all adopted as a standard because it would be confusing to have the existing standard in the book of standards and a tentative standard which represents the current knowledge on the subject. Under the present arrangement, if the specification is adopted by letter ballot, it will become a standard to be issued as such, although there will be in the book of standards until 1927 another standard specification for cement, which is the one which has been accepted by the American Engineering Standards Committee and promulgated as the "American Standard."

The new standard specification was entirely rewritten, but it contains only the following important changes:

1. Requirement of specific gravity is withdrawn from the specification and the methods of test for specific gravity are eliminated. The committee recommended this because as a result of its investigations it finds that apparently no useful purpose is served by the specific gravity test. That test is optional in the present standard and does not exist at all in the most of the European standards.

2. The requirements for tensile strength of standard mortar briquettes are increased from 200 to 225 lb. per square inch at the 7-day period and from 300 to 325 lb. per square inch at the 28-day period. The committee submitted a report of a subcommittee which had surveyed all tension tests of portland cement made in 1925. It was found that out of 172 reports received testing over 180,000,000 bbl. of cement about 0.7 per cent had been rejected under 200 lb. in 7-day requirement and 0.6 under 300 lb. in 28-day. If this is raised to 225 lb., the rejections would be 5.3 per cent; and for 250 lb. in 7 days, 17.1 per cent. With 325 lb. in 28 days, the rejections were 4.5 per cent; with 350 lb., 13.3 per cent. The committee reports, however, that there was an evident disposition among some users of cement to write specifications calling for a higher minimum tensile strength than the requirement of the present standard, and in view of the small percentages that would be rejected under the new clause they recommended its approval.

3. The specifications as a whole were rewritten, so as to agree with the phraseology of those written by the United States Federal Specification Board in its proposed master specification for portland cement, and the methods of test were changed in many particulars in order to guarantee a more comparable result. Some of the important changes in the methods of test were as follows:

(1) The purchaser is allowed to reject on a retest of soundness at time of setting after provisional acceptance at the mill. (2) Individual sampling from bins needs represent only 200 bbl. instead of the 100 bbl. of the old specification. The same applies to the general warehouse testing of the composite sample. (3) A clause is added that sampling shall be done by or under the direction of a responsible representative of the purchaser. (4) Containers of the samples are required to be moisture-proof in addition to being air-tight. (5) In the hand sieving method, the depth of the sieve has been increased from 1½ in. to 2 in. (6) A clause for temperature of the testing apparatus is as follows: "The temperature of the room, the materials, the mixing water, the moist closet and storage tank water shall be maintained as nearly as possible at 21 deg. C. (70 deg. F.) and the mixing water moist closet and storage tank water shall not vary from this temperature more than 3 deg. C. (5 deg. F.)." (7) A provision in the molding of briquettes has been added which requires that the pressure in molding shall be such that the simultaneous application of both thumbs will register a pressure of between 15 and 20 lb. It is reported that this provision if followed will deduct approximately 25 lb. from the strength of the cement briquette under what it would be if the operator put his full weight on the pressure.

A new subcommittee on sea-water cement and on early hardening cement is working on possible specifications for these materials.

Russell Greenman retired as chairman of the committee after nearly 10 years of service. His place as chairman is taken by P. H. Bates (U. S. Bureau of Standards). The new secretary, succeeding R. B. Young is F. H. Jackson (U. S. Bureau of Public Roads).

Other Papers—An interesting but somewhat recondite paper was read by Thomas Spooner, of the Westinghouse Research Laboratory, "The Magnetic Analysis of High Speed Steel," containing many results obtained with an alternating current magnetic test at fairly high magnetizing force, for various quenching and drawing treatments. The test is claimed to give a quick and reliable indication of the uniformity and absolute values of heat treatment temperatures; aging effects are also brought out by the tests. R. J. Anderson, of Cleveland, reported a great amount of experimental study on the heat treatment of duralumin sheets, which in general confirms and supplements previous data. The best general heat treatment for strength and hardness, he found, consists in quenching in water at 500 to 512 deg. C. followed by aging for three or four days at normal temperature. H. P. Hollnagel and E. A. Harty discussed "Can the Hardness of Materials Be Neglected in Granulometric Sieve Analyses?" tending to show that the manner of conducting a sieve analysis should be standardized. H. Styri, of the SKF Laboratories, described a new form of magnetic analysis under the title "Testing of Ball Bearing Races by Electric and Magnetic Methods," the method involving the use of a phase difference in the circuit. J. P. MacKenzie, in a paper "Relations Between the Proposed Standard Test Bar for Cast Iron and the Two Existing Standards," reported tests comparing the 1.20x18-in. proposed test bar, the 1.25x12-in. present arbitration bar, and the 1x2x24-in. cast-iron pipe standard test bar. The latter proved to give lowest values in strength and deflection. The other two bars agreed well, and the proposed 18-in. bar showed certain definite advantages over the arbitration bar. The curves of results were found to be parallel to the reciprocal of carbon plus one-third silicon.

"Effects of Size and Shape of Test Specimen on the Tensile Properties of Sheet Metals" was discussed by R. L. Templin, with the conclusion that elongation depends on cross-sectional area of the test piece; a specimen form was proposed as being best from all points of view. O. B. Schultz reviewed the forging of special steels in "Some Defects Which Have Been Found in Large Carbon-Vanadium Forgings, Their Causes and Prevention." M. C. Booze presented a study of the spalling test for fire-clay brick. A related subject was dealt with by the committee on refractories, which presented an industrial survey of refractories for open-air furnaces and for the copper and lead industries.

"Determination of Pressure Distribution on Circular Pipe When Tested in the A.S.T.M. Standard Flange Bearings" was presented by D. G. Miller and P. C. McGrew; "Microstructure of Zinc Coatings," by W. H. Finkeldey; "Aluminum Casting Alloys, the British Engineering Standards Association Specifications Reviewed," by George Mortimer; "Measurement of Consistency as Applied to Rubber-Benzene Solution," by W. H. Herschel and R. Bulkley; "Impact Testing of Insulating Materials," by W. W. Werring; "The Fluidity of White Metals," by E. R. Darby; and "Etching Characteristics of the Constituents in Commercial Aluminum Alloys," by E. H. Dix, Jr., and W. D. Keith. This last was a monumental presentation by microphotographs of unusual excellence, of the large range of constituents found in aluminum alloys, the probable composition and nature of these alloys, and an analytical scheme for identifying the constituents from micrographs.

In the field of paints and oils the following papers were presented: "Hiding Power of Pigments," by R. L. Hallett, which indicated that there may be a relationship between hiding power and tinting power of white pigment; "The Study of Nitro-Cellulose Lacquers by the Stress-Strain Method," by G. W. Rundle and W. C. Norris, which gave extensive data on a study as yet only begun, indicating remarkable and distinctive effects of different plasticizers on such lacquers, as measured by the distensibility of films of lacquer; "Mechanical Testing and Recording of the Drying of Paints and Varnishes," by J. M. Sanderson; and "Accelerated Weathering, Further Developing of Apparatus and Exposure Cycles," by H. A. Nelson, F. C. Schmutz, and D. L. Gamble.

Committee Work—The reports of the specification committees, their revisions and drafts of new specifications were almost wholly of a character to interest only the specialist, or the industry directly concerned. Only a few items are noted in the following:

A new specification for steel rails was presented by the steel committee, a copy of the latest specifications of the American Railway Engineering Association with substitution of head-up drop test for a head-down test. This near-harmonizing of opinion follows upon eight or ten years of seemingly hopeless disagreement between the two organizations. The new specification does not provide for acceptance or rejection of rails, but for their grading. The committee on fireproofing presented a complete revision of its prior specification for fire-test procedure, the new draft also being before the sectional committee on this subject of the American Engineering Standards Committee; the new draft is much more precise and explicit, and at the same time is somewhat easier in its fire-stream requirements, than the old. The committees on corrosion of iron and steel and on screen wire cloth reported progress on their large-scale exposure tests. Some interesting specifications for prepared roofing, both continuous and shingle, were submitted by the bituminous waterproofing and roofing materials committee. In copper wire, minor revisions were made for the sake of intersociety harmony. A single, general specification for structural timbers, that of the Central Committee on Lumber Standards, was submitted by the timber committee to replace the present separate specifications for yellow pine and fir.

One of the most voluminous committee reports was that of Committee E-1 on methods of testing, which is now so broadly organized as to be prepared to deal with all aspects and elements of test methods. This committee presented a summary of impact testing and reported a recommended procedure. In revising its methods for calibrating testing machines by means of elastic calibration bars, the committee has made a change which will allow any form of mechanical piece or structure to be used in place of a bar.

Organizational Matters—J. H. Gibboney, of Roanoke, Va., was elected president of the society, and Gustave W. Thompson, of New York, was elected vice-president. C. M. Chapman, W. F. Edwards, W. B. Price and H. T. Shelley are the new members of the Executive Committee.

One or two administrative changes of some importance were recommended by the Executive Committee and were approved by the society at the meeting. These include publication of the triennial book of standards in two sections, each member to be furnished with only one of the two sections and to have the privilege of purchasing the other. The institution of Student Membership was also authorized. Finally, the establishment of a permanent fund by the management of the society was approved, this fund to be accumulated through special but informal annual subscriptions.

Retiring president W. H. Fulweiler, addressing the meeting on "The Importance of Little Things in the Standardization of Methods of Testing," gave unusually valuable warning as to the care needed in the practical application of the testing art, both in the writing of specifications and in their execution.

Effect of Sulphur on Rivet Steel—Summary of Findings

Sulphur Up to 0.06 Per Cent Found Harmless—Larger Amounts Reduce Ductility, Toughness and Strength of Riveted Joints

Final Report of Joint Committee on Investigation of the Effect of Phosphorus and Sulphur in Steel on the first problem taken up.

SUMMARIZING its elaborate investigation of the effect of sulphur content upon rivet steel, the Joint Committee on Investigation of the Effect of Phosphorus and Sulphur in Steel reported to the American Society for Testing Materials last week that sulphur up to at least 0.06 per cent is not detrimental, while above this figure many of the strength properties remain unaffected but ductility, impact resistance, and the shearing strength of riveted joints decrease. The facts of the investigation are summarized by the committee in the attached diagram, which represents a plotting of the percentage variations from the average of each of the properties involved in the test, the abscissas being percentage of sulphur content. In each case separate curves are given for the material as received, annealed, and quenched. Certain irregularities in the various test curves are ascribed to the variation in manganese and carbon content, which is plotted in the two lower curves. The principal findings of the committee are:

"These conclusions may properly be considered valid only for the type of rivet steel used in this investigation, namely, a steel with a carbon range of 0.09 to 0.15 per cent, manganese 0.35 to 0.64 per cent, phosphorus 0.005 to 0.024 per cent, silicon 0.002 to 0.057 per cent, and sulphur ranging from 0.03 to 0.18 per cent.

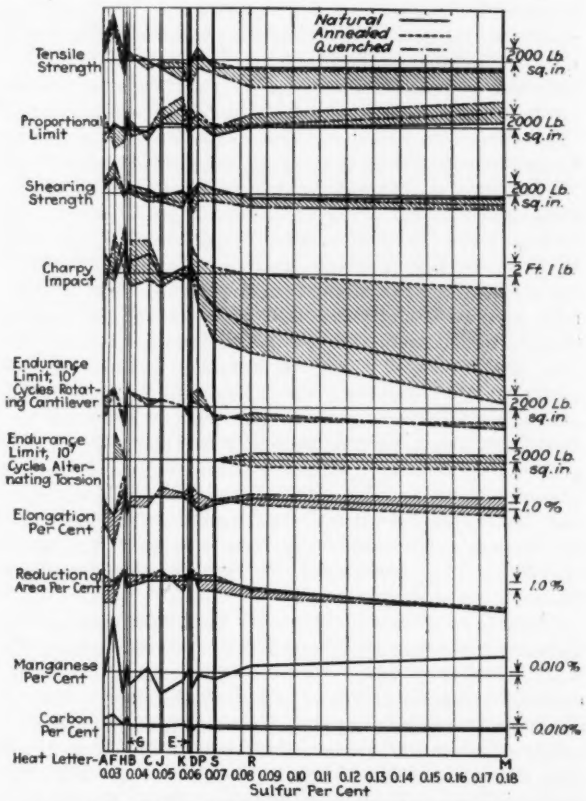
"*Rolling*—All of the ingots and billets rolled satisfactorily, including the ingot from heat M (S = 0.18 per cent), with the exception of the ingot from heat P (S = 0.063 per cent) which cracked some in blooming.

"*Reheating*—Rivet bars and slabs were rolled from ingots that had gone cold, and directly from hot ingots; and the hot or cold ingot heats cannot be identified from the properties determined.

"*Test Results*—The sulphur present in commercial rivet steel up to at least 0.06 per cent is not detrimental, the tests showing no systematic relation between any of the physical properties determined and the sulphur content up to 0.06 per cent.

"For the following properties determined for material in the natural, annealed and quenched conditions, no systematic relation with sulphur up to 0.18 per cent is shown by these tests: Tensile strength, proportional limit and yield point for material tested both parallel and perpendicular to direction of rolling; percentages of elongation and reduction of area for material tested parallel to direction of rolling; shearing strength; hardness; torsional properties; endurance limit; cold bend tests of bars; cold bending, hot flattening and hot and cold upsetting tests of rivets.

"Above sulphur of about 0.06 per cent, the values


Natural
Annealed
Quenched
Tensile Strength
Proportional Limit
Shearing Strength
Charpy Impact
Endurance Limit, 10⁷ Cycles Rotating Cantilever
Endurance Limit, 10⁷ Cycles Alternating Torsion
Elongation Per Cent
Reduction of Area Per Cent
Manganese Per Cent
Carbon Per Cent
2000 Lb. sq.in.
Ft. Lb.
1.0 %
0.010 %
Heat Letter- A F H B C J K D P S R M
0.03 0.04 0.05 0.06 0.07 0.08 0.09 0.10 0.11 0.12 0.13 0.14 0.15 0.16 0.17 0.18
Sulfur Per Cent

EFFECT OF SULPHUR IN RIVET STEEL

Summary of results of investigation by Joint Committee on Effect of Phosphorus and Sulphur. The two lower curves show (unintended) variation of carbon and manganese in the different heats of steel included; these variations are held responsible for the irregular variations in test results shown by the upper curves.

of the following properties decrease with increase in sulphur content; percentages of elongation and reduction of area for material tested perpendicular to direction of rolling, in the three conditions, natural, annealed and quenched; Charpy and Izod impact tests for all three conditions of the material tested parallel and perpendicular to the direction of rolling. Determinations of the gas content of this steel show an increase of the oxygen content with an increase in sulphur above 0.06 per cent. Hydrogen and nitrogen contents, which were also determined, were found to be small and constant throughout the series of steels.

"*Uniformity*—Attention should be called to the remarkable agreement in physical properties found in the total of 5,400 measurements of the various physical properties carried out independently in the two laboratories that made the tests. Watertown Arsenal and the U. S. Naval Engineering Experiment Station."

South Dakota University Stadium Built in Small Units

Design Based on Piecemeal Availability of Funds —Two Contracts Averaged $10 per Seat —Column and Seat Details

By J. Maughs Brown
Professor of Civil Engineering, University of South Dakota, Vermillion, S. D.

DESIGN of athletic stadiums is often greatly affected by the manner in which funds are supplied. Where all construction money is available at once, the design is comparatively simple; but where the stadium is built in units as funds are derived from athletic contests, small donations, yearly payments, etc., the engineer must accommodate his design to the most economical use of those funds, though remembering he is to provide, ultimately, a finished structure of pleasing appearance and ample structural value.

After the type of athletic field has been decided upon,

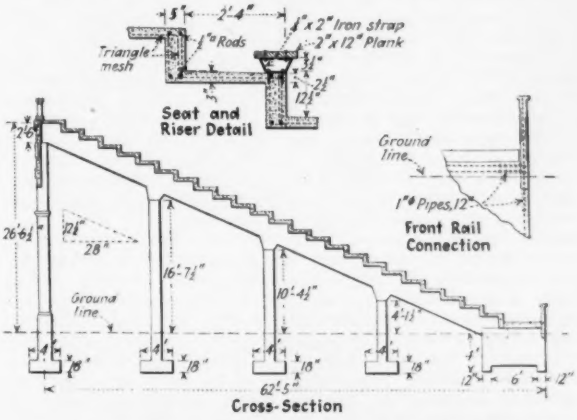


FIG. 1—SECTION AND DETAILS OF UNIVERSITY OF SOUTH DAKOTA CONCRETE STADIUM

the next problem, which is a complex one, is provision for maximum ultimate capacity. At the University of South Dakota the design was determined by the piecemeal method of raising funds so that the unit construction was adopted. The University of South Dakota stadium will ultimately be built up of a succession of 30-ft. sections. Though when these sections are all erected, the stadium will provide seating arrangements for about 16,000 when carried around the three sides of a U-shaped structure, the back wall above the arches is so designed that future extension in seating capacity can be provided with seats extended laterally. The back wall above the arches serves as windbracing so that very little spent for appearance will be lost should it later be covered up by an extension. In this particular case, it is estimated that such extension will not occur within thirty years, so the small extra cost to make the outside presentable is justified. The problem here was to get at once the most for the money available in the way of seating capacity and still have something that could form part of the much larger structure but in the meanwhile produce a pleasing and finished appearance. Though not all of these conditions can be fulfilled, the design shown is an attempt at a rational adjustment of the several factors.

One of the interesting details of the job is the use of flexible columns, and an attempt to proportion the longitudinal steel in the risers and backwall so that it will not only provide beam and wall reinforcement, but under extremes of temperature would exert enough residual pull to deflect the columns without cracking the concrete slab. The first units have been built long enough to determine how well this was accomplished. Up to the present time, there has been no cracking of the thin tread and riser slab or the back wall. The units act as such, moving back and forth with changes in temperature with almost as much precision as the mercury in a thermometer.

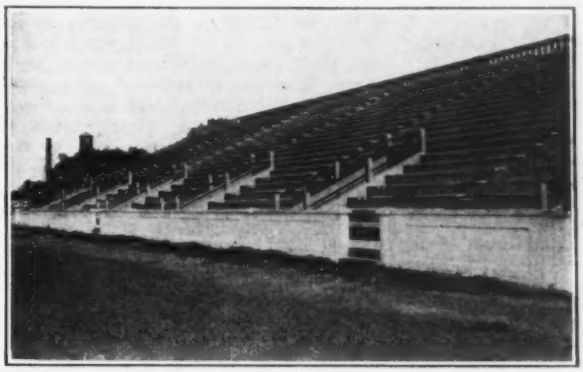


FIG. 2—FIRST FEW UNITS OF STADIUM COMPLETE

Another detail of interest is the method used in handling expansion and contraction of the railing where it was necessary to have motion longitudinally and fixation laterally. This was accomplished by running reinforcing bars through pipes buried into the holding concrete. The length and size of the pipes depend on the amount of movement to be provided for, and the length of bar needed to deflect the required amount without becoming overstressed at the base. Three-eighth-inch square bars threaded through 1-in. pipe from 10 in. to 12 in. long were used at several places, and they have proven satisfactory.

The main contraction movement is provided for by breaking the whole structure every 30 ft. with an expansion joint filled with ½-in. elastite filler between the double columns, girders and slabs. The ends of the double movable girders rest on expansion plates embedded in the end piers. These plates and others are made in the form of steel and sheet lead sandwiches.

The work so far completed has been done by local contractors, the first contract having been let in 1923 and the second in 1925. The cost of the work so far has been about $10 per seat for construction, including painting seats and grading. Local materials averaged the following prices delivered on the job: Stone, $4 per cu.yd.; sand, $3.20 per cu.yd.; cement, $3 per bbl. Common labor ran about 40c. per hour.

Water Sanitation 2,210 Years Old

In 284 B.C., according to *Health News* (New York State Department of Health), Aristotle gave the following advice to Alexander: "Do not let your men drink out of stagnant pools. Athenians, city-born, know no better. And when you carry water on the desert marches, it should be first boiled to prevent its getting sour."

Letters to the Editor

A FORUM FOR DISCUSSION OF VIEWS OF ENGINEERS AND CONTRACTORS

Management of Porto Rican Roads

Sir—Referring to the editorial notes in *Engineering News-Record*, June 3, 1926, entitled "Roads in Porto Rico," in which you state that: "Porto Rican highway development under the guidance of United States Army Engineers has followed . . ." Allow me to call your attention to the fact that our Bureau of Public Works here, having direct charge of the survey, construction and maintenance of roads and bridges in this island, is not directly or indirectly connected with the service of the United States Army Engineers. Since 1900, when the "Foraker Act" for a civil government for Porto Rico was established, all matters per taining to works of a public nature, such as road and bridge construction, were placed under the direct control of the Commissioner of the Interior who is appointed by the Governor of Porto Rico with the advice and consent of the Senate of Porto Rico.

At present the Commissioner of the Interior is Mr. Guillermo Esteves, a graduate civil engineer.

San Juan, P. R., June 16, 1926. ENRIQUE ORTEGA, Assistant Superintendent of Public Works.

Pipe Line Construction for Athens, Greece

Sir—The amount of water flowing into the Acian and Neurvia reservoirs forming a part of the water-supply system of Athens, Greece, has been doubled following the construction of a pipe line during the past year.

The American company that is handling the operation found considerable 24-in. and 16-in. pipe stored near the work so that it was enabled to make an early start. Work was begun September 8, 1925, on the pipe line which made seventeen crossings under the old Haduan aqueduct that was built about 150 A.D. This aqueduct zigzagged down the mountainside, evidently following a stable rock formation. In order to get under the masonry of this aqueduct, the excavation for the pipe line had to be carried to a depth of about 20 ft. Such a depth was necessary because a 14-in. wall extending down about 20 ft. had been built at many points in order to protect the aqueduct from the mountain flows which are very violent after a rain. Much care had to be used in blasting this rock from under the aqueduct.

Excavation on the pipe line trench was done in units of 3x3x13 ft., a bulkhead of earth and rock being left in at the end of every 13-ft. section. This was done not alone to save timbering, but to save the trench from the mountain flows. This unit system of excavation was also a good check on the amount of work that could be turned out by the laborers. Two laborers worked each 13-ft. unit, one using a pick, the other a shovel. When excavation reached a 14-ft. depth, a windlass was rigged up and the spoil hauled out in baskets. The operation was done on task work. When the laborer finished, he was at liberty to remain and start a new task or to go home. His task of 5 cu.m. netted him 60 drachmas, which is about 75 cents in American money.

Since only 24-in. and 16-in. pipe was available, the 24-in. pipe was laid in a single line to which were connected two parallel lines of 16-in. pipe. Between the 16-in. lines a 4-in. line was placed to be used as a feed line for the householders along the line of the work. On this 4-in. line house connections were placed consisting of 1-in. pipe placed looking straight up. As all the buildings along the line of the work now drawing from the old aqueduct use pumps, these will be used on the 4-in. line. It is the intention to feed this 4-in. line from the Haduan aqueduct.

In laying the parallel lines of the pipe at the various crossings under the aqueduct, the rock was first removed to allow for the laying of only one line. After this was laid it was covered up with masonry which was carried flush to the bottom of the aqueduct. Then following this, the rock for the parallel line was removed, the pipe placed and the masonry operation repeated.

At one point the aqueduct sagged enough to interfere with the cast-iron pipe. The top of the aqueduct was removed and a steel plate 12 ft. long bent to egg-shaped section was inserted, following which the bottom of the aqueduct was torn out and the pipe laid underneath. The Haduan aqueduct was found to have a half-elliptical flow section lined with masonry and it had been constructed in tunnels.

The parallel 16-in. lines terminated in a concrete vault. From this two lines, a 24-in. line and a 14-in. line, led to the Acian reservoir, while a 16-in. line led to the Neurvia reservoir. Eight control valves were placed at the three entrances to the reservoirs. One of these reservoirs will be filled at all times.

New York City, May 1, 1926. J. P. HANLEY, Former Construction Superintendent on the Pipe Line Work.

Guaranteed Quantities Desirable

Sir—Referring to your Quantity Survey editorial in *Engineering News-Record*, June 10, 1926, p. 927, the wonder is the slowness of development of the practice here. With the long standing example of English construction business methods, and the educational efforts years ago of Architect G. Alexander Wright of San Francisco, and the advertising of the Quantity Survey Co. of New York, the advantages of the system should have been recognized earlier.

There is growing evidence of an increasing disposition among engineers and architects, and probably owners also, to accord to contractors, as bidders and as builders, a more equitable share in contract making and interpreting.

The common practice of requiring bidders on lump sum contracts to make their own estimates of quantities entails an economic waste unless the bidders join in employment of a competent and responsible quantity surveyor, and even then there is less saving and more gamble than when the owner furnishes and guarantees the quantities. Contractors as bidders have to gamble more or less on labor cost, and when they have to be responsible also for quantities the uncertainty is increased. But if the engineer's estimate of quantities is furnished and guaranteed the bidders are saved both the cost of figuring quantities and the fear of errors in their figuring, wherefore they need not add so large a percentage to cover so called contingencies—their expense of bidding will be less and they can safely bid lower, the owner getting advantage through lower and safer bids.

It is both fair and easy to guarantee the quantities furnished to bidders. The designer of the work, or a quantity surveyor working for him and with his help, is less liable to oversight regarding the material in it than is a stranger to the plans, and under the guarantee the owner pays for what he gets and only for what he gets.

But the full benefit of either form of the system can be realized by both contractors and owners only when the practice becomes general, so that contractors need not maintain extra help for estimating, and meanwhile, until owners who want lump sum contracts do generally issue guaranteed quantities, contractors can advantageously organize among themselves to employ quantity surveyors, although in public work any form of joint action of prospective bidders may be frowned upon as possibly constituting collusion.

Philadelphia, Pa., June 14, 1926. HENRY H. QUIMBY, Consulting Bridge Engineer.

Location of Lake Water Intakes

Sir—In the editorial note in your issue of May 27, p. 835, you comment on the fact that my article on lake waterworks intakes in the same issue does not discuss the location of intakes with reference to sewage pollution. If I had referred to this matter I would have said that it is practically impossible, within reasonable limits, to place lake intakes beyond the influence of sewage pollution if the town using the intake discharges its sewage into the lake. It generally is more economical and decidedly safer to install water filtration works and merely carry the intake to points beyond the range of excessive pollution, and where it will meet the other requirements referred to in my article. Just what constitutes excessive sewage pollution in lake waters subjected to filtration has not yet become a matter of general agreement. However in specific cases, engineers have little difficulty in determining excessive sewage pollution.

Chicago, Ill., June 7, 1926. PAUL HANSEN, Hydraulic and Sanitary Engineer.

News of the Week

CURRENT EVENTS IN THE CIVIL ENGINEERING AND CONTRACTING FIELDS

Lease of St. Lawrence River Power Favored

N. Y. State Engineer Favors River Development by Private Capital Under 50-Year Lease

(*Albany Correspondence*)

Stressing the necessity of the adoption of some practical method of development of St. Lawrence River power, while preserving for the people their rights of ownership and control, but not depriving capital of initiative and a fair return on an investment, the report of State Engineer Roy G. Finch, rendered to the New York State Water Power Commission on June 29, declares that the state can at any time take over the entire development, perhaps at a figure less than had the state itself financed and constructed the project. The State Engineer also declares that this provision, coupled with that relating to the immediate execution and filing of a quit claim deed transferring to the people without cost all properties at the expiration of the license period, should eliminate any fear that the development of this power under a lease is a gift to any concern or corporation.

The report was prepared at the request of the New York State Water Power Commission, to assist it in disposing of the applications before it for development of St. Lawrence River power. It is intended to estimate the possible horsepower, to recommend essential provisions in leases, and to suggest the sum to be paid annually to the state treasury by the companies or corporations developing and distributing such power as may be available.

Estimated Income

Estimating $2.50 per year per horsepower as the reasonable license fee to be paid to the federal and state treasuries by the company developing the power, Mr. Finch contends that this would mean more than one million dollars a year in revenue to New York State at the outset and would be increased from year to year as a market is found for all the power that can be produced. The development would be approximately 2,500,000 hp., one-half of which would belong to Canada and the other half on the American side of the international boundary.

Plans for Development

The plans for development before the Commission contemplate an investment of approximately $225,000,000. Any proposal accepted will be under a license determining that the investment within the boundaries of New York State will become the property of the people of the state at the end of fifty years. The state will thereby profit at the rate of two per cent each year on this investment which would be equivalent to adding another $2,250,000 annually to the state treasury.

Several proposals for the development of the international section of the river have been presented and it is assumed that the plan will either be a single or a two-stage development. "There are, to both, advantages and disadvantages. From the standpoint of New York State it would seem that a single stage development would be more desirable."

[The plan of the Frontier Corporation (*Engineering News-Record*, Apr. 15, p. 627), calls for a single stage development. The original plan of the American Super-power Corporation (*Engineering News-Record*, May 13, 1926, p. 786), called for a two-stage development. Later the American Super-power presented four plans, but

(*Concluded on p. 32*)

Engineering Fifty Years Ago

From *Engineering News*, July, 1876

The Detroit Tunnel

It is often hard to the uninitiated to discover the motives which so often determine the failure or success of some engineering work which, in an engineering point of view, is entirely feasible. Such is the case of the Detroit Tunnel; a scheme which was well under way some three years since, the trial shafts and headings of the drainage tunnels having been pushed far enough to determine its practicability. The difficulties, it is true, were greater than was anticipated, but not of such a character as to warrant its abandonment; yet the railway companies saw fit to give out that great difficulties had been met with and that the expense of its completion would involve its failure in a financial point of view.

Probably the truth is that the railway companies would very much like to place all possible obstruction to lake commerce in the Detroit River, and accordingly, ever since, they have advocated a low bridge with two draws. Anyone acquainted with the nature and extent of the commerce that passes Detroit knows how such a bridge would affect it.

A bridge built under the restrictions imposed by the Government Engineers would be an enormous and unwarranted expense, and so if one is ever built the railways must rely on such influence, of an uncertain character, as they can bring to bear on legislative enactment.

San Gabriel Project to Get Another Hearing

Hearing on the Los Angeles Flood Control Controversy to be Continued in July

(*Washington Correspondence*)

Following the hearing held in Washington June 14 and 15 on the question of the location of the construction railroad to the Forks dam site on the San Gabriel River in California for the dam proposed for the Los Angeles County Flood Control District, it was announced that the city of Pasadena had been given until July 15 to file a reply and that another hearing will be held on July 16. The location of the railroad to the Forks dam site is, in itself, of minor importance, but because two departments of the federal government are concerned with issuing a grant of right of way, it has been used to bring the whole matter of the conflict over flood control plans at Los Angeles to the attention of federal authorities. An outline of the controversy was given in our issue of June 3, 1926, p. 890.

Federal Authorities Act

When the matter of the location of the railroad was first brought to the attention of federal authorities, a committee was appointed by the Secretary of the Interior to hear evidence and make a report. The committee consisted of F. J. Safley, chairman, U. S. Land Office, Salt Lake City; F. E. Bonner, District Engineer, U. S. Forest Service, San Francisco; and H. D. McGlashan, District Engineer, U. S. Geological Survey, San Francisco. This committee began its hearing early this year as reported in our issue of March 25, 1926, p. 501, and it has submitted a majority and minority report to the Secretary of the Interior recently.

Majority Report

The report of the majority was submitted by Mr. Safley and Mr. McGlashan, and the minority report by Mr. Bonner. Neither report has been made public, but it is understood that the majority has reported that most of the matters heard by the committee have little interest to the government and are matters of private controversy, that there is little difference in costs between the two dams proposed and even though there were differences in costs, this fact would not justify the government in withholding a permit for the location of the railroad right-of-way as long as the local taxpayers who understand all the details approved of the construction of the dam at the Forks site. The majority is also understood to have reported that as the plans of Pasadena for the construction of the lower reservoir have not been perfected and as the railroad through the site of the lower reservoir will only be required during construction of the upper

dam, its construction and use would not seriously interfere with the Pasadena project.

It is understood that the minority report takes into consideration the increased cost of the dam at the Forks site over the alternate or Granite Dike site and that the combined capacity of the proposed flood control and water supply reservoirs will be far in excess of the amount required for flood control; also the legal questions involved and the lack of co-operation between the various public agencies and recommends that all action on the application be suspended until a further study has been made and that the conflicting parties be required to adjust their difficulties before applying to the federal government for permits.

Ph.D. for Pacific Coast Editor of Engineering News-Record

Nathan A. Bowers, Pacific Coast Editor of *Engineering News-Record*, has received the degree of Doctor of Philosophy from Stanford University. Attention has been drawn to the award by the fact that this is the first time a civil engineer has received a Ph.D. at Stanford. As part of the requirements, Mr. Bowers submitted a thesis on "Engineering Failures in the Water Power Field." This subject was particularly appropriate because during sixteen years of editorial work with this journal he has specialized on hydro-electric developments and has had an unusual opportunity to personally investigate accidents and breaks in that field. An arrangement was made with Stanford whereby the thesis will not be available for public inspection and thus it was possible to include in it much confidential data not heretofore assembled for collective study. Mr. Bowers joined the staff of *Engineering Record* in 1910, and after two years in the New York office was sent to the Pacific Coast which territory has since then been his special assignment. His headquarters are at San Francisco.

Failure to Chlorinate Results in Damages for Typhoid

Damages of $2,000 collectible from Owen Sound, Ont., on account of alleged contraction of typhoid fever from the public water supply have been awarded to Miss Susie McQueen. The judge, a press dispatch states, "rebuked the civic authorities for not heeding warnings he said had been given them regarding the water last autumn. He declared chlorination of the water supply had been left off until the whole community was caught in the epidemic."

Women Engineers to Meet at Leeds University in September

The Fourth International Conference being arranged by the Women's Engineering Society is to be held at Leeds University, England, during the week-end of September 3-6. The details of the program have not yet been announced.

Memorial Scholarship Fund

The Little Rock Engineers Club, Little Rock, Ark., is raising a scholarship fund of $6,000 in memory of Major C. H. Miller, one of the engineers lost in the sinking of the Steamer *Norman*.

New Lackawanna Cut-off Opened

The Delaware, Lackawanna & Western Railway Company has completed and opened to traffic its new six-mile cut-off built at a cost of $2,000,000 to expedite the handling of freight through the congested area around Newark, N. J.

Philadelphia-Camden Bridge Opened to Traffic

On July 1 the Delaware River bridge between Philadelphia, Pa., and Camden, N. J., was opened to traffic. Some of the approach work and other finishing operations remain to be completed, but the structure is in condition to take regular traffic and normal operation was begun. Vehicle traffic is charged a toll for the use of the bridge, the returns going to the three bodies which furnished the money for construction: the states of New Jersey and Pennsylvania and the city of Philadelphia.

With a main span of 1,750 ft. between center of towers, the Philadelphia bridge now takes first place among the suspension bridges of the world in size.

Canadian Engineers Disapprove New Railway to Pacific Coast

A board of engineers made up of J. G. Sullivan, consulting engineer, Winnipeg; C. S. Gzowski, chief engineer of construction, Canadian National Railways; J. M. R. Fairbairn, chief engineer, and W. A. James, assistant chief engineer, Canadian Pacific Railway; and E. M. M. Hill, exploration and reconnaissance engineer of the Canadian National Railways, which has been studying the possibility of providing a new outlet for freight traffic from the Peace River District in northern Alberta, has reported against the construction of a new line across the Rocky Mountain range to the Pacific Coast. At the present time traffic from this region goes eastward and southward through Edmonton before turning west. The report states that the natural outlet from the vast potential territory of the Peace River region and that around Great Slave Lake to Vancouver is through Berwyn, a point a few miles west of the Peace River crossing, and that of the several possible routes, that of constructing a new line south to a connection with the Canadian National Railway at Obed, Alberta, offers less route miles than any of the other proposals. However, the engineers declare that from an economic standpoint a great deal more traffic will have to be developed in the territory before it will be economical to construct this new line as the minimum immediate outlay would amount to $13,336,000.

Two Breakwaters to Be Built on Southern California Coast

Early in May voters of Santa Barbara, on the Southern California Coast, approved a bond issue for $200,000 to which an equal amount is to be added by Max Fleischmann, a wealthy resident, for the construction of a breakwater to provide a sheltered anchorage in front of the city. Santa Barbara has retained Francis Betts Smith as a consulting engineer to design and supervise construction of the breakwater. Bids will probably be called for about Aug. 15. The breakwater is to be 1,200 ft. long. Preliminary estimates place the probable amount of rock required at about 150,000 tons. Completion of the work is expected about 16 or 18 months after award of contract.

The Palos Verdes estate, located on a point of land adjoining, and to the northwest of Los Angeles harbor, is also planning the construction of a breakwater. The primary purpose in this case being to provide a sheltered anchorage for a yacht harbor. Surveys and tentative plans are now being made for developing a breakwater at Bluff Cove which would have a length of about 2,000 or 2,500 ft. Its cost is estimated at $500,000 to $600,000 by Mr. Smith who has also been retained as consulting engineer on this work.

Large Bridges Dedicated

Two important new bridges were formally opened on June 23, the new highway bridge across the Raritan River between Perth Amboy and South Amboy, N. J., and the Hilliard Road bridge over Rocky River Gorge, a few miles west of Cleveland. The latter is a concrete arch viaduct of three spans of 196, 220 and 196 ft., with deck 125 ft. above the valley. The Perth Amboy bridge is a long plate girder structure on concrete piers on piles, with swing span at the navigation channel. Both are important links in the main highways of the states. The Perth Amboy bridge is on the main road from northern New Jersey to the entire shore district from Sandy Hook to Cap May and replaces an old bridge long inadequate in strength as well as in capacity to carry the very heavy traffic on this highway. It was built by the New Jersey Highway Commission, with Clarence W. Hudson as designing engineer retained for the work. The Hilliard Road bridge will constitute a new western entrance to Cleveland, relieving the highway crossing the old Rocky River single-span arch bridge a mile or more north of the new site. It was built by Cuyahoga County, to the design and under the direction of A. M. Felgate, bridge engineer for the county.

On June 16 the Great Western Gateway bridge over the Mohawk River and valley between Schenectady and Scotia, N. Y., was formally dedicated, although it had been in service for several months. It is a concrete structure 3,167 ft. long consisting of 24 arch spans 96 ft. to 209½ ft. long, and was built by the State of New York, under the office of the State Engineer, Roy G. Finch.

Gen. Taylor Succeeded by Jadwin as Chief of Engineers

On June 26 Major General Harry Taylor who has been Chief of Engineers, U. S. Army, for the past two years closed his active military career and retired to private life having reached the statutory retirement age. He has been succeeded by Major General Edgar Jadwin, former assistant

Maj. Gen. Edgar Jadwin

Chief of Engineers, whose appointment to the position of Chief of Engineers and promotion to the rank of major general was approved by the Senate recently. General Jadwin has been succeeded as Assistant Chief of Engineers by Brigadier General Herbert Deakyne.

General Jadwin, the new Chief of Engineers, was born in Honesdale, Pa., Aug. 7, 1865, and was appointed second lieutenant, Corps of Engineers, upon graduation from the U. S. Military Academy in the class of 1890, the same class with Herbert Deakyne, the new Assistant Chief of Engineers. Subsequently he served on river and harbor and fortification work at Galveston, Tex., and other gulf points and on similar work on the Atlantic and Pacific Coasts, as well as on inland river improvement. He also served as recorder of the board of engineers for fortifications at New York City. In 1908 he went to the Panama Canal as division engineer on the Chagres Division.

During the Spanish-American War General Jadwin served as a lieutenant-colonel of the 3rd U. S. Volunteer Engineers, and commanded the U. S. troops marching in Matanzas, Cuba, on the occasion of the transfer of sovereignty.

He went to France in 1917 in command of the 15th Engineers, and was appointed a brigadier general as chief of the engineer advance section, line of communication, as director of the Division of Construction and Forestry, and as Director of Light Railways and Roads. He was awarded the Distinguished Service Medal for this service.

General Jadwin is a Companion of the Order of the Bath (British), and a commander of the Legion of Honor (French). In 1919, he served as a member of the American Mission to Poland, and an observer in the Ukraine.

After his return to the United States he served successively as Engineer of the 8th Corps Area and Division Engineer, Southeast Division, on river and harbor work until his appointment, June 19, 1924, as Assistant Chief of Engineers. During his incumbency of this office he has also served as senior member, American Section of the Joint St. Lawrence Waterway Board; senior member, Board of Engineers for Rivers and Harbors; as member of Technical Advisory Committees of the Federal Oil Conservation Board, and of the American Delegation to the International Conference on Oil Pollution of Navigable Waters; and chairman of Technical Advisory Departmental Committee to the Joint Congressional Committee on leasing Muscle Shoals. The degree of Doctor of Engineering was conferred on him by Lafayette College in 1925.

Brig. Gen. Herbert Deakyne, the new Assistant Chief of Engineers, is a native of Deakyneville, Del., and a graduate of the U. S. Military Academy in the class of 1890. From 1893 to 1896 he was in charge of jetty construction at Humboldt Bay, Calif., and from 1896 to 1901 on fortification work at San Francisco and San Diego. From 1901 to 1903 in charge of similar work and also river and harbor improvement at Tampa, Fla. The following two years he served with engineer troops at Fort Leavenworth, Kan. From 1905 to 1907 he was in charge of lighthouse service and harbor improvements, on fortification work, and chief engineer officer in the Philippine Islands, returning to the United States in 1908 to take charge of fortification, river and harbor work at Philadelphia, Pa. At the same time he

Brig. Gen. Herbert Deakyne

became a member of the board of engineers for rivers and harbors. From 1912 to 1916 he was in charge of river and harbor improvement at Kansas City, Mo., going to the office of the Chief of Engineers at Washington in 1916. In 1917 he organized the 19th Engineers (Ry.) and went to France with that unit, later becoming commanding officer of the 11th Engineers, then director of Light Railways and Roads, and later chief engineer of the Paris Group. When the second army was organized he was appointed chief engineer with the rank of brigadier general, a position which he held until after the Armistice. Upon his return to the United States, Colonel Deakyne went to New Orleans as division engineer, and then, in 1920, to San Francisco, as division engineer, Pacific Division. In 1925, Colonel Deakyne was appointed division engineer, Northeast Division, with headquarters at New York City.

Minneapolis Voters Snow Under Council-Manager Plan

The proposed council-manager charter for Minneapolis, Minn., was defeated on June 21 by a vote of about 55,000 against to 26,000 for with nearly a 60 per cent majority required for its adoption. Objection to a change from ward to proportional representation, or if the latter should be declared unconstitutional then redistricting from 13 to 12 wards is given as one of the chief reasons for the defeat and labor opposition as another. A third contributing cause may have been provision for a board of financial review, with supreme control over appropriations and bond issues if set in motion by a taxpayers' petition which need have only 100 signatures (see editorial comment, June 10, p. 829). A more potent cause of the defeat may have been conservatism, evidenced by the defeat of six of seven earlier proposed charters, beginning in 1898, the one adopted providing for nothing but municipal home rule.

Program for Summer Meeting of Civil Engineers Annnounced

The program for the summer meeting of the American Society of Civil Engineers, to be held in Seattle, Wash., July 14-16, has been announced. The meeting will be opened by addresses of welcome on Wednesday morning by Governor Hartley, of Washington, and Mayor Landes, of Seattle, to be followed by a symposium on "The Logging and Lumbering Industries of the Pacific Northwest," with papers and discussions by civil engineers in the lumber industry. The afternoon session will be devoted to the same subject, with special reference laid upon reforestation.

Meetings of the technical division will begin on Thursday with concurrent meetings of the city plan division, highway division, power division, and structural division in the morning, and meetings of the construction division, irrigation division, sanitary engineering division and waterways division Thursday afternoon. For those not attending the division meetings on Thursday, there will be local excursions.

On Friday there will be an all-day excursion to the plant and logging operations of the Snoqualmie Falls Lumber Co. where electric power is used in practically all the logging operations. A trip to the Lake Cushman hydro-electric power development also has been arranged.

RANDOM LINES

Cotton Socks as Business Getters

The following editorial, from which names have been deleted, appeared in the Norwood, Minn., *Times* last March:

Through the good offices of Waconia friends, the ——— Engineering Company of ——— was tipped off that things were not as they should be in Norwood, anent the waterworks situation. That company dispatched their Mr. ———, the engineer who put the work through at ———, to Norwood, to offer his services here. Accompanied by a brother engineer, he visited Norwood Saturday afternoon, called on some of our businessmen and was directed to the *Times* office. We gladly shut down our plant for the best part of the afternoon to confer with the two gentlemen and to acquaint them with the few facts in our possession regarding the waterworks situation. Our statements, briefly summed up, are about as follows:

"The engineering firm we have been dealing with have sent their men here at divers times during the past five years, all wearing fancy striped silk stockings and voicing a stilted academic brand of English, so that our citizens are, and have been from the first, mistrustful of their statements, with the result that mistrust has taken the place of the usual thoughtfulness devoted by our citizens to questions of this nature; that the silence of the engineers, when asked irrelevant questions has been construed by the 'opposition' as weak spots in the Water Works proposition; that the opposition has built up an argument from a set of fanciful figures compiled by their leader; in short, that the waterworks proposition is being stabbed in the back, because the engineers persist in wearing 'blinders.'"

The writer was well and favorably impressed with the appearance of Mr. ———. We noticed he wore cotton socks like our own (he had his feet on our desk). We got the impression while listening to him talk that he has command of a dandy vocabulary of unstilted cuss words. You'll like him, too. He is very anxious to meet the leader of the opposition of whom he had already heard much. In this connection we aided all we could to advance his store of knowledge. In short Mr. ——— is just an ordinary honest appearing plug of a fellow who might well be mistaken by a stranger to be a resident of this honest community.

Mr. ——— feels that the prospect for a lively contest here is worthy of his mettle, yet he is one of the quietest men you ever met. We know of his honest efforts through his work in ———, ———, ———, and other places. He told us he is willing to check up the survey, figure out cost of waterworks and sewerage for this town, meet our citizens in mass meeting, answer ALL questions pertaining to the subject, argue the merits of the proposition with anyone; and that if the proposition fails he will take the blame—the community will owe him nothing. If the proposition goes through all he asks is that we judge him by his work here and elsewhere, and give him consideration when selecting an engineer. Their charges for superintending construction work is the same as all the reliable engineering firms charge, namely, five per cent, legal and all other overhead expenses 1½ per cent, all these expenses included when the engineer submits his estimate. We considered his proposition a most fair one, introduced him to the chairman of the committee and others, all of whom said they saw no objections to anyone checking up the survey and telling us the truth of the figures, as long as the village was obligated in no way to pay for it. So, if you see tripods standing on our streets one of these days don't reach the hasty conclusion that the village council, or anyone else, has engaged engineers to come here to make another survey.

And, says the engineer who sent in this clipping, they say there is no such thing as "engineering english."

Albany Takes Definite Steps for New Water Supply

The city council of Albany, N. Y., has passed an ordinance providing for a new water supply in accordance with Chap. 643, Laws of 1926, and has appropriated $300,000 for the initial expenditures.

Lease of St. Lawrence River Power Favored

(Concluded from p. 29)

stated that it favored a single-stage development as being the most feasible and practical.]

"With proper safeguards to protect this state," the report continues, "the decision as to a single- or two-stage development is not vital, but the provisions in a license are of the utmost importance. Every precaution must be set up not only to preserve the rights of the people in the ownership and control of this natural resource, but to insure to them the benefits to which they are justly entitled. But we should not insist upon requirements or commitments on the part of the licensee that will deprive capital and initiative a fair and proper return on an investment, which involves greater risks and calls for more engineering skill, financial assistance and civic determination than has ever been exacted in any similar public or private proposal."

The report outlines provisions to be written into the lease.

James H. Gibboney Elected President of A.S.T.M.

James H. Gibboney, chief chemist of the Norfolk & Western Ry. Co., was elected president of the American Society for Testing Materials at its convention in Atlantic City, June 21-25.

Mr. Gibboney was educated at Virginia Polytechnic Institute, graduating in 1901 in chemical engineering. He was connected for the next five years with the teaching and engineering experiment station staff of the Virginia Polytechnic Institute. In 1906 he entered the railway service with the Norfolk & Western Ry. Co.

Mr. Gibboney has been a member of the A.S.T.M. since 1906. He is an active member of a number of its important committees, including those on steel, preservative coatings for structural materials, cast and malleable iron, petroleum products and lubricants, and corrosion of iron and steel, of which latter committee he has been chairman since 1921. He served on the executive committee of the society in 1915-17 and as vice-president, 1924-26.

Mr. Gibboney is a member of the American Railway Association, having served for years upon its committee on specifications and tests for materials; of the American Railway Engineering Association, in which he holds membership on the committees on water service and rails; and of the American Chemical Society, American Wood Preservers Association and American Society for Steel Treating.

Contract Awarded on Additional Oral Bid Illegal

The litigation conducted by the Associated Pennsylvania Constructors to upset the improper award of work at Masontown, Pa., was brought to a successful conclusion on June 7 when Court of Quarter Session at Uniontown, Pa., handed down a decision declaring contract between the Borough of Masontown and F. J. Foye illegal. After receiving regularly advertised bids on three contracts at Masontown, the Borough Council saw fit to award two of them to F. J. Foye, Brownsville, Pa., on a lower, and oral, bid received one week after regular proposals were opened. Morris Knowles, Inc., of Pittsburgh, engineers for the Borough of Masontown, immediately declined to supervise construction in protest against the method of award followed by the Borough Council. In co-operation with three of the bidders on this work (one of whom should have received the award of the contract in question) the Association retained attorneys at Pittsburgh and Uniontown and brought the matter to adjudication. It was felt that, allowing such procedure to go unchallenged might open the door wide to all sorts of fraud in the award of public construction work in this state and set a most unwholesome example.

New Railway Lines Authorized in Competitive Territory

The Chicago, Rock Island and Pacific Railway Co., and the receivers of the Chicago, Milwaukee & St. Paul Railway Co., have been authorized to undertake the construction of new railway lines in Freeborn County, Minn. The line of the Chicago, Rock Island and Pacific is to extend from a connection with its Iowa-Minnesota Division near Clark's Grove in a general easterly direction through the town of Hollandale to Maple Island, a distance of approximately 9.3 mi., all in Freeborn County, Minn. The receivers for the St. Paul asked for authority to build into Maple Island but have only been authorized to construct a line extending from the southern Minnesota Division of the St. Paul to a point east of Hollandale, where a connection will be made with the proposed line of the Rock Island. The authority for the Rock Island to construct its line is conditioned upon its granting the right to the St. Paul to operate over the line from Hollandale to Maple Island, with joint use of facilities between those points. Construction of both lines is to start before July 1 and completed on or before September 15, 1926.

Engineering Societies

Calendar

Annual Meetings

AMERICAN SOCIETY OF CIVIL ENGINEERS, New York, N. Y.: Summer Meeting, Seattle, Wash., July 14-16; Annual Convention, Philadelphia, Pa., October 4-9, 1926.

NEW ENGLAND WATER WORKS ASSOCIATION, Boston, Mass.; Annual Meeting, Providence, R. I., Sept. 14-17, 1926.

INTERNATIONAL CITY MANAGERS' ASSOCIATION, Lawrence, Kansas; Annual Convention, Colorado Springs, Colo., Sept. 21-23, 1926.

The Utah Society of Engineers at its annual dinner meeting June 10 elected as president, Murray Sullivan, assistant to the president of the Salt Lake & Utah R.R.; vice-presidents, J. A. Hale and Lloyd Garrison; secretary and treasurer, respectively, R. R. Wooley and R. K. Brown, both re-elected.

The Detroit Engineering Society at its June 25 meeting, to which it invited the Detroit Aviation Society, had an address by Col. Paul Henderson, general manager of the National Air Transport, Inc., of Chicago, on "Air Freight and Express Service."

The Iowa Association of Engineers at its annual meeting, held June 16 and 17 at Cedar Rapids, elected the following officers: President, Frank J. Parks, of Davenport; vice-president, W. A. Pike, Marshalltown; secretary, Clyde A. Bland, Des Moines; and treasurer, John Baumgartner, Davenport.

The North Carolina Section of the American Water Works Association will hold its annual convention at Wilmington Aug. 23 to 25.

Personal Notes

GEORGE S. DAVISON, president of the American Society of Civil Engineers, and president of the Gulf Refining Co., Pittsburgh, Pa., received the degree of doctor of engineering June 14 from Rensselaer Polytechnic Institute.

HENRY ELTINGE BREED, consulting highway engineer, New York City, was given the degree of doctor of science by Colgate University June 14.

W. S. MADDOCKS, formerly head of the electrical engineering department of Lockwood, Greene & Co., Inc., has terminated his service with that concern to become associated with Stone & Webster, Inc., as engineer in the electrical division at its Boston Office.

ERWIN A. CHILDERHOSE, for the past three years electrical engineer with the Pennsylvania Water and Power Co. and prior to that with the Manitoba Power Commission, has entered the electrical division of Stone & Webster, Inc., of Boston, Mass. Mr. Childerhose is a graduate of the University of Manitoba.

PAUL B. COVEY, formerly with the F. C. Lyons Iron Works and the New Hampshire Structural Steel Co., of Manchester, N. H., has organized the Manchester Engineering & Welding Co. for the purpose of specializing in the application of welding to steel construction.

WILLIAM R. TAYLOR has resigned and retired from active service as engineer of the Bureau of Water at Binghamton, N. Y., after twenty-two years of service. His successor is to be Norman H. Johnson.

JOHN M. BISCHOFF, for fifteen years a construction engineer in Detroit, Mich., has been appointed commissioner of buildings and safety engineering for the city of Detroit.

PAUL D. SARGENT, chief engineer of the highway commission of Maine, received the degree of doctor of engineering from the University of Maine at its recent commencement; Mr. Sargent is a graduate of the university.

H. DEB. PARSONS, consulting engineer, New York City, and a graduate of Stevens Institute, was given the degree of doctor of engineering at its commencement recently.

IRVING E. BROOKE, formerly of Muir & Brooke, has opened an office in the Security Building, Chicago, for the practice of general engineering. Mr. Brooke specializes in power plants, heating and ventilating and mechanical equipment.

ROBERT D. MCCARTER and WILLIAM L. COOPER announce dissolution of partnership under the name of McCarter & Cooper. Mr. McCarter has joined the firm of Day & Zimmerman, Inc., of Philadelphia, and is now located in Paris as their sole correspondent. Mr. Cooper will be located in London as American commercial attaché, in charge of the work of the United States Bureau of Foreign and Domestic Commerce in Great Britain.

THOMAS H. MESSER, of San Francisco, has been appointed city manager of Coronado, Calif. He has been a consulting engineer for 22 years.

MAJOR L. E. LYON, Corps of Engineers, U. S. Army, who for the past three years has been on duty with the 6th Engineers, at Camp Lewis, Wash., has been assigned to duty as district engineer at Montgomery, Ala.

L. R. MILLER, Tokyo, Japan, superintendent for James Stewart & Co., Inc., contractors for the Mitsui Main Building, in Tokyo, has been appointed superintendent for the foundation work, etc., for the Mitsui bank and office in Tokyo.

F. L. SCHNEPFE has tendered his resignation as district engineer for the fourth highway district of North Carolina to accept the position of county highway engineer of Manatee County, Florida, the county in which Sarasota is located.

ALBERT H. MYERS, for several years with Wellman-Seaver-Morgan Co. as engineer in the hydraulic turbine department, and later with Warren D. Spengler, Inc., as chief engineer, has recently joined the hydraulic division of Stone & Webster, Inc., Boston, Mass.

W. W. CROSBY, recently location engineer of the Pennsylvania State Department of Highways and formerly chief engineer of the State Roads Commission of Maryland, was given the degree of doctor of engineering at the University of Maine at its commencement June 14.

Obituary

WILBUR F. MCCLURE, state engineer of California since 1912, died suddenly on June 22 while on a field inspection trip. Mr. McClure was a native of Springfield, Ohio, and a graduate of the Pennsylvania State Normal College. He went to California in 1887 and took up engineering work in the employ of the Union Pacific R.R. He was engaged in engineering work for the federal government for some years and just prior to the appointment to the state engineer's office had served as commissioner of public works and city engineer of Berkeley, Calif., where he put the city's engineering work on a high plane. During his 14-year service as state engineer Mr. McClure gave particular attention to water resources and irrigation development and took a leading part in the important progress made during this time in legal and financial matters affecting the organization of irrigation districts.

Construction Equipment and Materials

A SECTION DEVOTED TO WHAT THE MANUFACTURER IS DOING FOR THE ENGINEER AND CONTRACTOR

New Board of Governors for Mixer Manufacturers

The Mixer Manufacturers Bureau of the A.G.C. held a meeting at Milwaukee, Wis., June 8. The major problems of the Bureau and its relation to the construction industry were discussed. Election of members of the Board of Governors held an important place on the program. The following elections to the Board were made: To serve for one year: (chairman) Harold E. Smith, T. L. Smith Co., Milwaukee, Wis.; George C. Ellis, Ransome Concrete Machinery Co., Dunellen, N. J.; Philip Koehring, Koehring Co., Milwaukee, Wis. To serve for two years: Clifford F. Messinger, Chain Belt Co., Milwaukee, Wis.; O. G. Mandt, American Cement Machine Co., Keokuk, Iowa.

Asphalt Sales Increase

Sales of asphalt and asphaltic materials manufactured from petroleum at refineries in the United States during 1925 amounted to a total of 3,178,370 short tons, which is an increase over the 1924 sales of nearly 100,000 tons, or 3 per cent, according to the Bureau of Mines, Department of Commerce. These sales were valued at $42,825,770, an increase over 1924 of 19 per cent.

Asphalt for paving purposes was again the most important variety, its production registering a gain in 1925. Asphalt to be used in the roofing and waterproofing trades was second in importance, but its production remained stationary as compared to 1924.

Sales at the mine of native asphalt and related bitumens in the United States in 1925, including bituminous rock, gilsonite, and wurtzilite (elaterite), amounted to 584,850 short tons, valued at $4,148,400. This is an increase over 1924 of 4 per cent in quantity and of 5 per cent in value. Kentucky led in the production of these materials. Of the various products bituminous rock was first in quantity and value.

Business Notes

AMERICAN BROWN-BOVERI ELECTRIC CORP., New York City, announces the purchase by the United Electric Light & Power Co. New York City, of a 60-cycle turbo generator for installation at its Hell Gate station. The rated continuous load capacity is 160,000 kw. or about 215,000 hp. The unit, which is claimed to be the largest yet built, will be built at the Camden plant of the Brown-Boveri Co. Nearly two years will be required for the building and installation.

MASSILLON STEEL JOIST CO. OF THE PACIFIC COAST, at 309 Rialto Building, San Francisco, has recently been formed so as to insure satisfactory service to the purchasers and users of the materials produced by the Massillon Steel Joist Co. of Canton, Ohio. J. L. Clymer is vice-president and general manager of the Pacific Coast company. Mr. Clymer came to this present position from the California Institute of Steel Construction, of which he was executive director.

SANITATION CORP., New York City, which has furnished Riensch-Wurl screens and other equipment for several New York City sewage-works, and the Awixa Corp., contractors, building the new Jamaica sewage-works, for New York City, were hosts on May 24 to sixty engineers and others including a number of New York City officials on a visit to some of the plants. The Dyckman Street plant in Manhattan and the North Shore and Jamaica plants in Queens were visited. The latter, now under construction, is the largest Riensch-Wurl plant yet built or contracted for. Foundation work on this plant was described in *Engineering News-Record*, June 24, p. 1016.

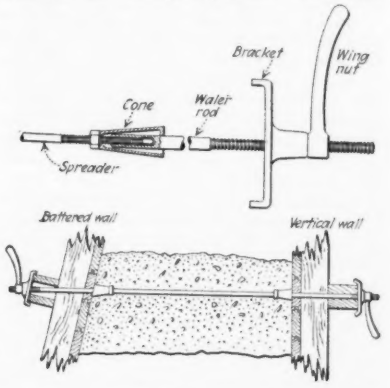
CECIL R. LAMBERT CO., INC., Detroit, designing, manufacturing and installing conveying and handling equipment, announces that its name has been changed to Mechanical Handling Systems, Inc. Additions are being made to the plant and personnel, but no change in ownership, management or executive staff is to be made.

New Developments

Form Clamp Used Equally Well on Vertical or Battered Walls

To take the place of wire, rods and wooden spreaders, the Williams Form Clamp Co., Inc., 219 W. Chicago Ave., Chicago, Ill., has developed the clamp illustrated below. It consists of a spreader or tie rod, at each end of which are screwed two nuts which determine the width of the form. These nuts allow an adjustment of 5 in. The small tapered cone, waler rod screwed over the end of the spreader rod, wing nut and bracket complete the assembly. One of the greatest advantages claimed for the clamp is that it can be used equally as well on battered or vertical walls. Another advantage is that clamps can be re-attached to the exposed spreader rods for use in suspending falsework or scaffolding. Also, scaffolding platforms may be clamped onto the precast walls, and the forms for the next pour above may also be fastened to the precast walls. Waler clamps are made in such a way that 2x4's or 2x6's are used for walers.

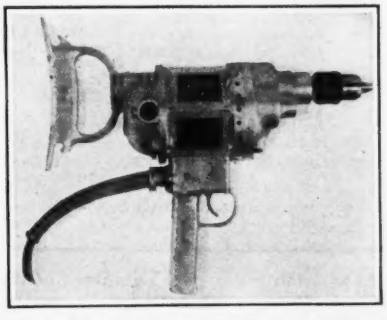
It is claimed that the small rod that is left in the concrete is cheaper than wire. Another advantage claimed for this clamp is that it permits the clamping and alignment of one side of the wall independent of the other. Because of this fact there is no necessity of getting down between the forms and working in cramped places. The New



York Central Railroad, and Pere Marquette have standardized on the Williams form clamp, as well as the State of Michigan, which has adopted them for use on all concrete work throughout the State.

Portable Electric Drill

A heavy portable electric drill in a $\frac{7}{16}$-in. size is a new product of the Black & Decker Mfg. Co., Towson, Md. It uses a pistol grip and trigger switch and weighs about 10½ lb. The no-load



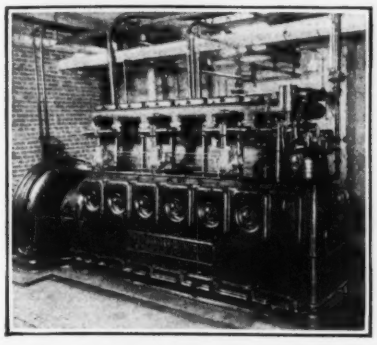
speed is 1,400 r.p.m. It is equipped with a three-jaw hand tightening chuck for which no chuck key is required. It is available for 110, 220, 250 or 320 volts.

Medium Speed Gas Engine for Power Plant Use

Operating on gas, gasoline, kerosene, or alcohol, the type T reserve engine, manufactured by the Foos Gas Engine Co., Springfield, Ohio, is adapted for power plant use, both as a continuous and standby unit. A lighter weight and smaller installation area is obtained than is possible with the Diesel engine, since the operating characteristics are of a somewhat lighter nature. The engine is built in combination of 2, 3, 4, 6, and 8 cylinders, covering a rating of 25 to 300 hp. In order to meet the requirements in the field, the stand-

ard synchronous speeds for electric service are 450, 514, 600, 720, and 900 r.p.m. The engine is entirely inclosed, even to the cylinder heads which are covered by a plate attached to the engine by a hinge for inspection purposes.

Bearings on each side of the crank are claimed to be 100 per cent over-size and the piston pin bearings are 120 per cent over-size as compared to average automobile practice. Cylinder heads are patented and removable without disturbing either manifold. The head is designed to give water circulation about each valve seat and stem, and

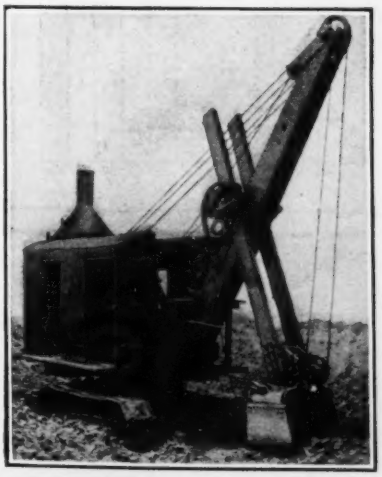


this water circulation is independent for each cylinder head. Ignition consists of two complete independent high tension systems with two sets of plugs.

One of the main features of the design is that the valve in head type used permits the employment of symmetrical combustion space which is claimed to increase the efficiency by minimizing the exposure of surface to the combustion.

New 1 Yard Shovel

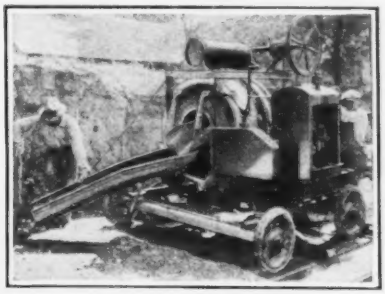
Having over-all dimensions no greater than those of most ¾-yd. shovels, the new 31-B machine just introduced by the Bucyrus Co., South Milwaukee, Wis., can maneuver in comparatively



small space, and at the same time deliver a one-yard output. This machine is quickly convertible to a dragline with a 40-ft. boom, and is also offered as a clamshell or crane.

Cross-wise Trucks on Building Mixer

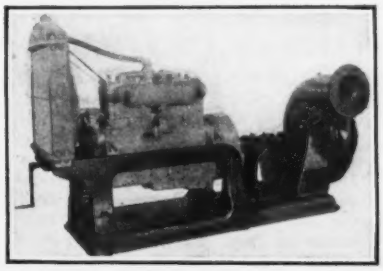
By mounting its building mixers on cross-wise trucks the American Cement Machine Co., Inc., Keokuk, Iowa, makes its machine into an end-discharge alley paver. The illustration shows one being so used by the Kelly Construction



Co., at St. Joseph, Mo. From the illustration it may be seen that these trucks may be removed and the wheels placed on the axles, making the machine into a side discharge building mixer again. It is claimed to take about 10 min. to make the conversion from side to end mixer.

Engine Base Designed to Mount Direct-Connected Units

Placing its gasoline engine power units on an extended sub-base designed for mounting direct-connected equipment such as generators and pumps is a new practice recently inaugurated by the Climax Engineering Co., Clinton, Iowa. The company prefers to supply only the power unit allowing



the customer to purchase direct the connected equipment, but is equipped to mount the driven unit on the base should the customer not have facilities for doing it. Four power units are available, three being four-cylinder engines and one a six-cylinder engine. It is said that this mounting was developed as the result of a demand from generator and pump manufacturers for power units of this type.

New Publications

Home Construction — PORTLAND CEMENT ASSOCIATION has made available two helpful booklets on home construction. The first, "Book of Beautiful Homes," contains 49 pages of illustrations and skeleton plans of homes in every part of the United States. The foreword contains some concise information about concrete masonry construction. The second booklet, "Portland Cement Stucco Surfacing," concerns itself more with methods used in obtaining a variety of textures with a stucco finish. Condensed specifications are given, together with several pages of typical construction details, besides the illustrations of many buildings and homes using stucco surfacing.

Feed Water Heaters—WORTHINGTON PUMP & MACHINERY CORP., New York City, describes in a new catalog its feed water heaters and boiler feed pumps. Advantages, economies, application, maintenance and operation of these pieces of equipment are given, together with descriptions and drawings showing details. Many illustrations are given of engines upon which the units are installed. Appendix 1 is a technical discussion on the reduction in heat required to generate steam. Appendix 2 on fuel saving. Appendix 3 on increase in steaming capacity. Appendix 4 on water saving, and Appendix 5 on tests of the equipment by railroads in United States, Canada, New Mexico and Europe.

Hoists—SULLIVAN MACHINERY COMPANY, Chicago, in Bulletin No. 76-G, describes its electric portable hoist of similar design to its turbinair hoist. Besides description and detail views, several pages of photographs of installations are given.

Welding Rod — CHICAGO STEEL & WIRE CO. has issued a research bulletin on the "Strength of Surface Materials on Steel Welding Rods." A study of the effects of surface material, such as lime, iron oxide, copper, nickel, cobalt, tin, etc., was made, and the results are reported in this booklet. The last few pages are devoted to a catalog of gas and electric store rods. Tables give comparative properties of various types of rod.

Pumps—DEAN HILL PUMP CO., Anderson, Ind., has just published two circulars Nos. 203 and 1501, describing respectively the construction of its horizontal single suction centrifugal pump and its reciprocating deep well pump head.

Power Shovels—THEW SHOVEL CO., Lorain, Ohio, has issued a small fifteen-page booklet entitled, "Why the Lorain 75 was Designed," which reviews the shovel industry for the past 31 years, giving the requirements that have made the many changes in design necessary.

Doors and Trim—COBURN TRACK MFG. CO., Holyoke, Mass., in its catalog No. 72 gives much detailed information and drawings for metal covered doors, frames, trim, partitions, windows, etc. Many illustrations are given of buildings utilizing the company's products.

Water Softening — GRAVER CORP., East Chicago, Ind., describes its Zeolite water softening equipment in a new bulletin. In addition to a description of the method used, illustrations are given of both installations and of the softening equipment.

Engineering News-Record Statistics of the Construction Industry

July 1, 1926 — *in the United States* — Vol. 97, No. 1

Engineering News-Record CONSTRUCTION COST Index Number (1913 = 100)

MONTHLY

January, 1925 to Date

July, 1926	**207.80**
June, 1926	204.80
July, 1925	204.60
Peak June, 1920	273.80
1913	100.00

1925

Jan....	210.40	May...	207.20	Sept..	202.10
Feb....	209.70	June...	204.60	Oct...	205.35
March.	210.20	July....	204.60	Nov. .	205.95
April..	209.55	August.	204.60	Dec...	205.95

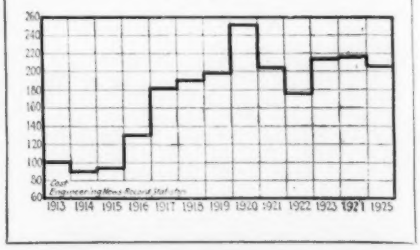
1926

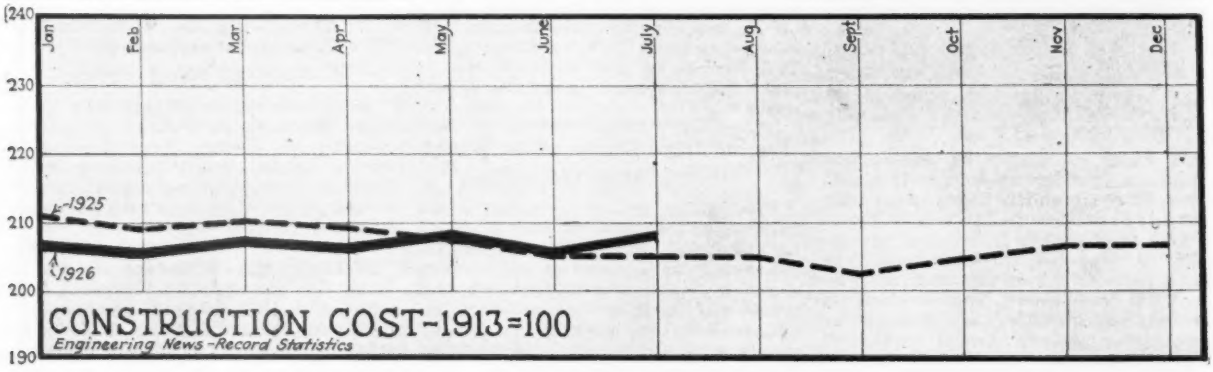
Jan...	207.15	Feb....	206 55	Mar....	207.65
	April...207.05		May....207.30		

ENGINEERING NEWS-RECORD'S Construction Cost Index Number is 1.4 per cent above June, 1926, owing to higher quotations on steel and increased cost of labor. The average rate for common laborers is 55¼c. per hr. for the entire country as compared with 55c. one month ago and 53c. at this time last year. Thus, general construction cost is 1.5 per cent above July, 1925, 24 per cent under the peak and 107 per cent above the 1913 level.

YEARLY

1913 to 1925





Engineering News-Record CONSTRUCTION VOLUME Index Number (1913 = 100)

MONTHLY

January, 1925 to June, 1926

June, 1926	**246**
May, 1926	254
June, 1925	214
Peak, August, 1925	266
1913	100

1925

January...	141	May....	209	September..	262
February..	145	June....	214	October....	233
March....	161	July.....	178	November..	194
April.....	211	August...	266	December...	206

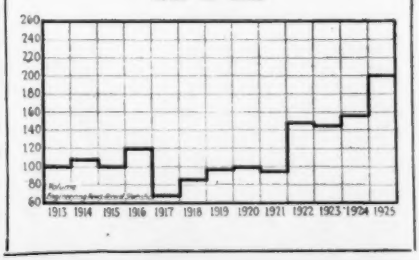
1926

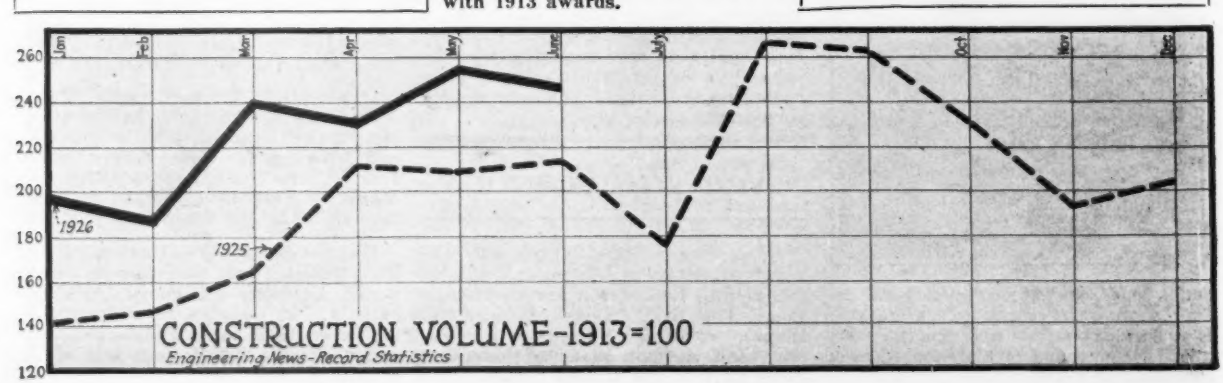
Jan.....	198	Feb.....	187
		April.....	233
Mar.....	240		

ENGINEERING NEWS-RECORD'S Construction Volume Index Number is 246 for the month of June, and 201 for the whole of 1925, as against 100 for 1913. This means that the actual volume of construction in 1925 (not the mere money-value of the contracts let that year) is 101 per cent above the volume of construction for 1913. The monthly volume number, 246 for June, 1926, contains the increment of construction and indicates the rate at which contracts are being let as compared with 1913 awards.

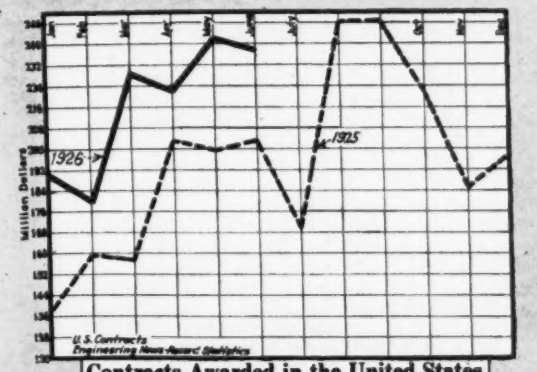
YEARLY

1913 to 1925

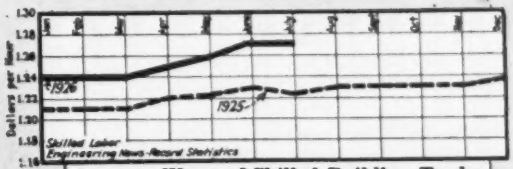




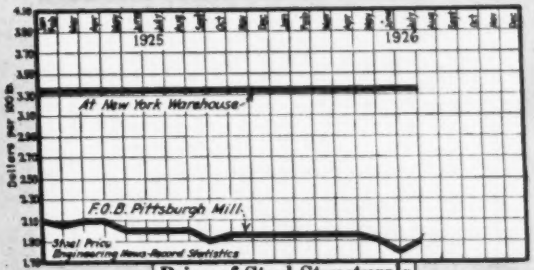
Monthly Statistics of the Construction Industry



Contracts Awarded in the United States
Reported to E. N.-R.

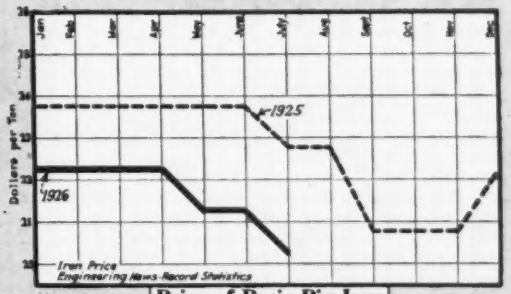


Average Wage of Skilled Building Trades
Bricklayers, Carpenters and Steel Erectors

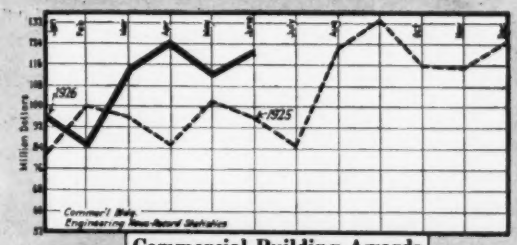


Price of Steel Structurals
Shapes 3-In.; Plates ¼-In.

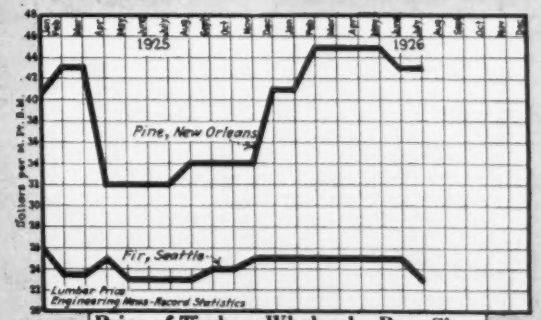
Industrial Building Awards
$40,000 and Over



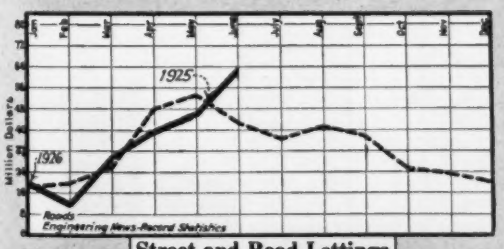
Price of Basic Pig Iron
F.o.b. Pittsburgh



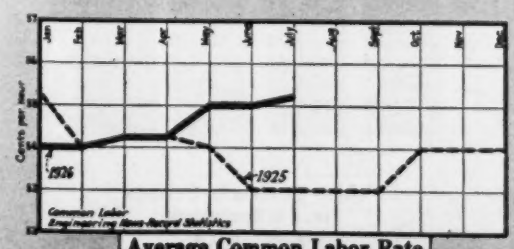
Commercial Building Awards
$150,000 and Over



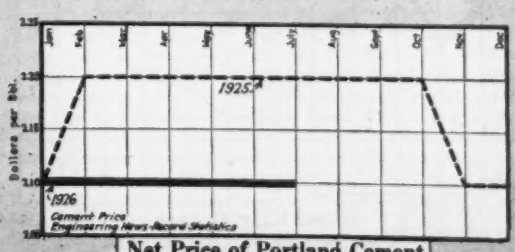
Price of Timbers, Wholesale, Base Sizes
Car Lots to Contractors



Street and Road Lettings
$25,000 and Over

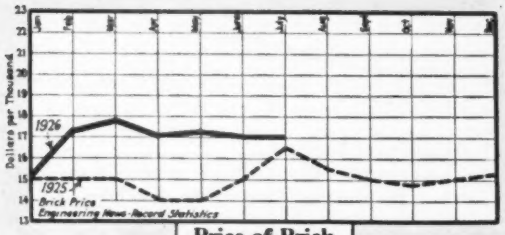


Average Common Labor Rate
Pick and Shovel Men

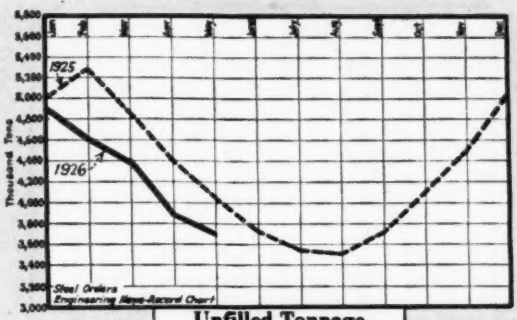


Net Price of Portland Cement
Car Lots, F.o.b. Chicago

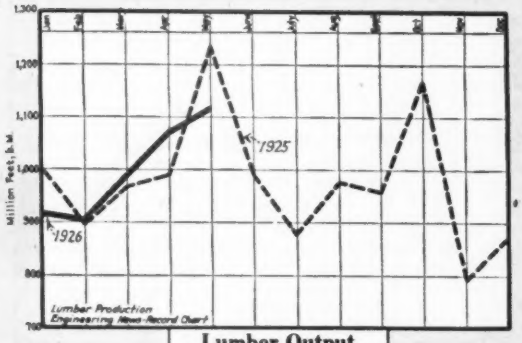
Monthly Statistics of the Construction Industry



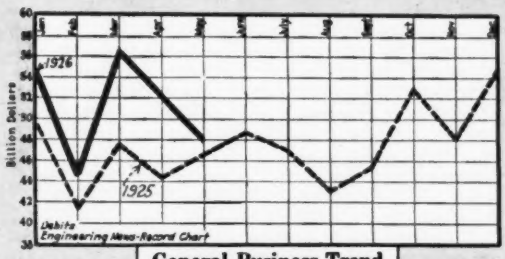
Price of Brick
At Dock, New York



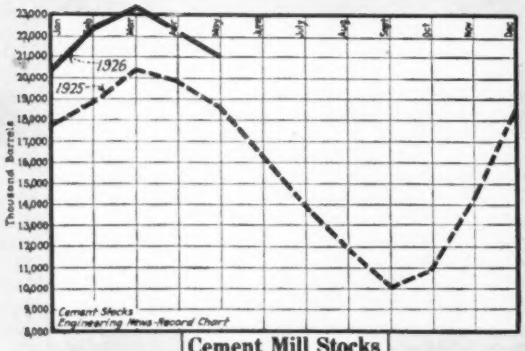
Unfilled Tonnage
On Books of U. S. Steel Corp.



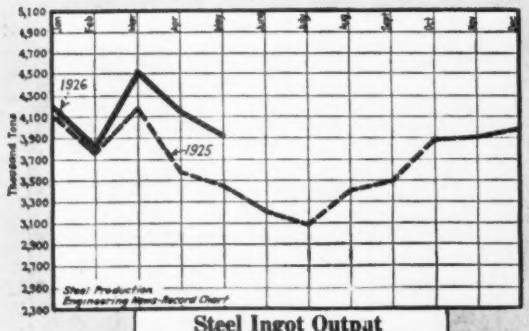
Lumber Output
Nat. Lumber Mfrs. Assn.



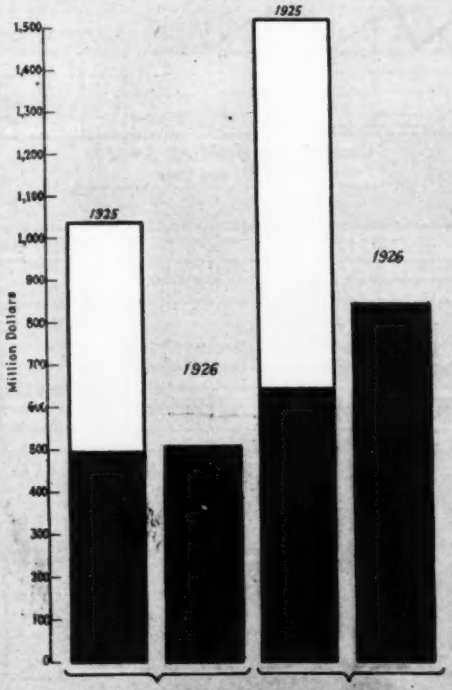
General Business Trend
Bank Debits—Federal Reserve



Cement Mill Stocks
Bureau of Mines



Steel Ingot Output
Gross Tons; Am. Iron and Steel Inst.



Public—Contracts—Private
Jan. 1 to date
Reported by E. N.-R.

Volume of Engineering Construction, In Project as Well as Awarded, Continues Large

Trend Is Obviously Downward In Speculative Housing

VOLUME of engineering construction, proposed as well as awarded, continues substantially ahead of a year ago. The trend, however, is obviously downward in speculative housing construction, vacant residential buildings and new but untenanted stores being everywhere in evidence.

Contracts awarded throughout the United States on engineering construction projects, totaled $237,625,000 for the month just closed. Of this total, $138,904,000 was for buildings and $98,721,000 for construction other than buildings.

The June, 1925, total was $203,479,000, of which $113,721,000 went for buildings and $89,758,000 for other classes.

May, 1926, aggregated $241,337,000; buildings accounted for $137,553,000, and other construction for $103,784,000.

In arriving at these totals the customary minimum was observed in each case, eliminating the small jobs and bringing the contracts under the classification of engineering construction, as follows: Waterworks and excavating projects, $15,000; other public works, $25,000; industrial buildings, $40,000; apartments, hotels, commercial, religious, educational, and institutional buildings, etc., $150,000.

Thus it is seen that June awards were ahead of the month preceding and June, 1925, so far as buildings of the class last mentioned are concerned. Industrial building is declining, although the June total was only one per cent under a year ago.

Construction other than buildings is about 4 per cent below May and 10 per cent greater than awards in June, 1925.

Proposed work, the most reliable barometer of the construction trend, is substantially ahead of a month ago and also a year ago, in grand total and in buildings. Construction other than buildings, however, declined to a very slight degree, in volume of projected work, during June.

In the first six months of the current year, proposed construction totaled $2,961,866,000, against $2,452,351,000 for the same period of 1925. This of course is at the minimum previously mentioned for each class.

Twenty-six of the forty-eight states showed declines in construction volume during June. No one section was particularly affected, the recessions being widely scattered throughout the country.

Value of Contracts Let in the United States and Canada During June, 1926

	New England	Middle Atlantic	South	Middle West	West of Mississippi	Far West	United States	Jan. 1 to Date U. S.	Canada
Water-works	$206,000	$1,726,000	.....	$864,000	$360,000	$246,000	$3,402,000	**$29,334,000**	$115,000
Sewers	174,000	1,474,000	$610,000	3,912,000	1,898,000	871,000	8,939,000	**47,985,000**	178,000
Bridges	854,000	2,331,000	899,000	915,000	2,088,000	350,000	7,437,000	**34,683,000**	.....
Excavation, drainage, irrigation	21,000	926,000	.....	19,000	870,000	457,000	2,293,000	**12,367,000**	83,000
Streets and roads	4,339,000	18,950,000	7,109,000	18,822,000	8,656,000	4,883,000	62,759,000	**222,473,000**	1,936,000
Industrial buildings	2,580,000	4,755,000	450,000	7,830,000	1,710,000	482,000	17,807,000	**174,621,000**	93,000
Commercial buildings	15,508,000	41,008,000	4,037,000	32,217,000	15,282,000	13,045,000	121,097,000	**702,305,000**	2,215,000
Federal Government	36,000	371,000	261,000	775,000	26,000	301,000	1,770,000	**22,418,000**	.....
Unclassified	542,000	5,532,000	1,036,000	1,272,000	1,188,000	2,551,000	12,121,000	**113,821,000**	5,814,000
June, 1926	$24,260,000	$77,073,000	$14,402,000	$66,626,000	$32,078,000	$23,186,000	$237,625,000	**$1,360,007,000**	$10,434,000
May, 1926	22,656,000	68,617,000	34,945,000	52,619,000	40,210,000	22,290,000	241,337,000	.....	12,849,000
June, 1925	20,508,000	57,691,000	23,870,000	38,993,000	39,818,000	27,599,000	203,479,000	.....	8,515,000
Jan. 1 to date, 1926	**103,199,000**	**452,836,000**	**156,540,000**	**310,477,000**	**191,096,000**	**145,859,000**	**1,360,007,000**	.....	62,921,000
Jan. 1 to date, 1925	100,156,000	387,695,000	96,958,000	200,667,000	205,815,000	147,068,000	1,138,359,000	.....	40,474,000

Labor Rates and Conditions Throughout the Country

Building Trades Strikes on the Wane

FULL employment for construction labor in most of the important industrial centers throughout the country, is practically assured for the rest of the current year, according to the volume of work now in the proposed stage. June engineering construction projects, definitely reported in *Engineering News-Record* as proposed, were considerably greater in money value than those for the preceding month or the corresponding period in the peak year 1925. Upward trend in employment is evident in several of the other major industries, such as, metals, machinery, automotive, mining, except bituminous coal, rubber, agriculture, iron and steel; the last mentioned is now running at 80 per cent of capacity, against 68 per cent at this time last year. Slowness, however, is reported in textiles, shoes and pottery.

The average wage rate for skilled building trades mechanics is unchanged from the June level and is about 4 per cent higher than on July 1, 1925, taking the nation as a whole. The common laborers' rate is 0.4 per cent higher than a month ago and 4.2 per cent above that of July last year.

Fewer Strikes in Building Trades

Major disturbances in the building trades, affecting twenty cities a month ago, are now confined to eight localities throughout the country.

San Francisco carpenters are still making violent efforts to prevent manning of jobs by non-union mechanics, following the walk-out in this trade nearly two months ago.

Philadelphia cement finishers are on strike for $1.25 per hr. and a closed shop. The recent strike of non-union steel erectors has practically resulted in defeat for the mechanics. The painters have evidently lost out also, since open shop conditions prevail at present in this trade. There is an over-supply of carpenters and other building trades mechanics in Philadelphia; electricians, however, continue in demand.

Syracuse, N. Y., building laborers went on strike during the past month for a wage advance of 10c. per hr.

Rochester, N. Y., building trades mechanics walked out in protest against working under police protection necessitated by the recent strike of building laborers.

Troy, N. Y., masons' and bricklayers' strike tied up over a million dollars worth of construction during the past month.

Providence, R. I., bricklayers have been on strike since May 1 for an advance of 15c. per hr. over the old rate of $1.35. An agreement for two years at the increased rate is probable.

Detroit carpenters on rough work are striking for the same rate as that paid finish carpenters. The present rate for rough work is 90c. to $1 and that for finish, $1.15 per hr.

There is marked surplus of common laborers in Boston and Dallas. The latter city reports the heaviest slump in building during the past ten years industrial construction is at a standstill. St. Louis construction continues to decline from the record peak of 1925. Unemployment in the Los Angeles district is not so pronounced as it was a month ago.

Cleveland painters and glaziers, who have been on strike since Mar. 1, are nearing agreement with the employers. The former demanded $1.50 per hr. and the five day week; the glaziers are reported to have asked for $1.37½. Both will probably return at the old wage of $1.25 per hr., pending settlement on a new scale. The five-day week proposition has evidently been abandoned.

Settlements during the past month include the following major adjustments: Hartford, Conn., hod carriers and building laborers returned at the old wage of 90c. per hr.; Kansas City hoisting engineers resumed work at the old scale of $1.12½ per hr., with a rate of $1.19 to become effective Sept. 1, the

Current Building Trades Wage Rates Per Hour

(Higher rates indicated by +, decreases by —)

Cities	Bricklayers	Carpenters	Hoisting Engineers	Hod Carriers	Pile Drivers	Structural Iron Workers	Common Labor
Atlanta	$1.12½	$0.70	$0.70	$0.50	.....	$0.75	$0.25@.30
Baltimore	1.62½@1.75	.90@1.00	1.00@1.12½	1.00	$0.65	1.12½	.40
Birmingham	1.00@1.50	.35@.87½	.75@1.00	.50@.75	.....	.75@1.75	.20@.40
Boston	1.40	1.25	1.25	.79	1.15	1.25	.50@.74
Cincinnati	1.50	1.31¼	1.31¼	.95	1.31¼	1.31¼	.45@.58
Chicago	1.62½	1.37½	1.37½	.87½	1.37½	1.37½	.82½@.87½
Cleveland	1.50	1.25	1.30	.87½@1.10	1.10	1.50	.87½
Dallas	1.62½	1.12½	1.00	.40@.75	.87½	1.00	.30@.50
Denver	1.62½	+1.25	1.12½@1.18¾	.81¼@.87½	1.00	1.15¾	.40@.55
Detroit	1.50	+.90@1.15	.85@1.00	.90	.85@1.00	1.12½	.50@.60
Kansas City	1.50	1.12½	1.12½@1.25	.90	1.12½	1.12½	.40@.75
Los Angeles	1.37½	1.00	1.00	.87½	.80	1.00	.50
Minneapolis	1.25	.87½@95	.87½	.75	....	1.00	.45@.60
Montreal	+1.10	.80	.60	.40	.50	.80	.30@.35
New Orleans	1.25	.90	1.00	.75	.85	1.25	.35@.40
New York	1.75	1.50	1.75	1.12½	1.00@1.12½	1.50	.90⅝
Philadelphia	1.50@1.62½	1.12½@1.25	1.02½	1.12½	1.00	1.12½@1.25	.45@.50
Pittsburgh	1.62½	1.50	1.37½@1.50	1.12½	....	1.50	.80
St. Louis	1.75	1.50	1.50@1.65	1.15@1.25	1.25	1.50	.45@.75
San Francisco	1.25	1.00	1.00	.81¼	1.00	1.12½	.50@.55
Seattle	1.37½	1.12½	1.00@1.12½	1.00	1.00@1.12½	1.12½	.50@.62½

engineers together with the carpenters demanded $1.25 but the latter are being hired back at $1.12½ per hr. on an open-shop basis; Aberdeen, Wash., carpenters accepted $1.06¼, an advance from the old rate $1, after having demanded $1.12½; Denver, Colo., carpenters agreed to a rate of $10 per day on jobs awarded since Jan. 23, the former wage of $9 applying on all previous contracts; Washington, D. C., carpenters accepted an advance of 50c. per day instead of the $1 originally demanded, the agreement to hold until 1928; Chicago structural iron workers returned to the job pending a grant of $1.50 per hr., effective Oct. 1, the present rate of $1.37½ to remain in force until then, also, beginning July 1, the bricklayers will receive $1.62½, against the old rate of $1.50, plasterers receiving the same.

Monthly Prices of Construction Materials

Ups and Downs of the Market

DEMAND as measured by engineering construction in the proposed stage as well as actual contracts let, is heavier than on July 1, 1925. Prices of materials, however, show marked steadiness, since it is this semblance of stability rather than prospects of increasingly lower markets, that serves to encourage building. Steel is up $2 per ton; lumber is weaker; cement clay products, lime, and the aggregates remain fairly firm. Labor costs will probably hold at present high levels for the remainder of the current year.

Pig Iron—Prices are $1 per ton below a month ago at Cincinnati, New York, Birmingham, Chicago, and Pittsburgh. Buying is active in the Mid-West and New England.

Railway Supplies — Standard and light rails remain firm at prices in effect at this time last year. Re-rolled rails are down $2 to $3 per ton from last month's levels. Oak ties show a declining trend at St. Louis, while standard spikes are up 10 to 20c. per 100 lb. at Pittsburgh mill.

Pipe—Quotations hold firmly to the June levels on steel and cast-iron pipe and clay drain tile; sewer pipe, sizes 24-in. and under, are lower at factory points.

Road and Paving Materials—Asphalt rose $1 per ton in St. Louis and declined about the same amount in Montreal and Atlanta, compared with June quotations. Paving stone, flagging, curbing and wood blocks remain unchanged.

Sand, Gravel and Crushed Stone—Prices of the aggregates remained fairly steady during June in the twenty-one cities reporting regularly to *E. N.-R.*

Lime and Cement—Lime is firm and shows little tendency to change. Out of a total of forty-six localities, only two report price fluctuations in cement during the past thirty days. A slight deviation occurred in Los Angeles and severe price cutting is reported in Montreal. The present figure of $1.15 per bbl. now being quoted in the latter city, is the lowest price recorded at that point, during the past seventeen years.

Brick and Hollow Tile—All of the clay products except brick, show little tendency toward price fluctuation at the outset of the summer building season. Common brick declined 50c. in Minneapolis, $1 in Philadelphia, and $2.50 per M. at Los Angeles since June 1; Cleveland prices went up $2 in the meantime.

Structural Steel—In contrast with the present quietness in the pig-iron market, steel buying is more active than it was a month ago. Structurals are particularly promising, while bar demand is a trifle slower, following the recent spurt. The market is usually easier at this time of the year. Quotations on the principal hot-rolled products, in carload lots or over, are as follows: bars and shapes, $2 per 100 lb. with $1.90 mentioned on exceptional tonnages; plates, $1.85@$1.90, f.o.b. Pittsburgh mill.

Lumber—The market is weak; there are sixteen declines to three advances, comparing current prices with those in effect a month ago.

Scrap—Firmness with upward tendencies is evident in Western scrap markets. New York shows marked declines in several grades, compared with June 1 quotations.

Miscellaneous—Most of the materials not previously mentioned show no price change from the June 1 levels with the exception of manila rope, which developed four declines to one advance and steel sheets, which dropped 10c. on blue annealed and 15c. per 100 lb. on galvanized at Pittsburgh mill. Linseed oil is up 5½c. at New York and 6c. per 7½-pound gallon at Minneapolis.

Business Briefs

Call money quoted at 5 per cent, June 28; year ago 6 per cent.

Time loans: Sixty-ninety days, 4¼; four-six months, 4¼ per cent.

Commercial paper: Best names 4 per cent; other names, 4½ per cent.

E. N.-R. Prices of Construction Materials

Price advances since last month are indicated by **heavy type**; declines by *italics*

PIG IRON—Per Gross Ton f.o.b.:

CINCINNATI	July 1	One Year Ago
No. 2 Southern (silicon 2.25@2.75)	$24.05	$23.05
Northern Basic	24.27	22.27
Southern Ohio No. 2 (silicon 1.75@2.25)	*23.27*	22.77
NEW YORK, tidewater delivery		
Southern No. 2 (silicon 2.25@2.75)	*27.37*	27.37
BIRMINGHAM		
No. 2 Foundry (silicon 2.25@2.75)	*21.00*	19@20
PHILADELPHIA		
Eastern Pa., No. 2X (2.25@2.75 sil.)	23.26	23.26
Virginia No. 2 (silicon 2.25@2.75)	28.67	29.17
Basic	22.26	22.26
CHICAGO		
No. 2 Foundry Local (silicon 1.75@2.25)	22.50	22.00
No. 2 Foundry Southern (silicon 2.25@2.75)	*25.05*	25.55
PITTSBURGH, including freight charge ($1.76) from the Valley		
No. 2 Foundry Valley (silicon 1.75@2.25)	*20.27*	22.77
Basic	*20.27*	22.77
Bessemer	*20.27*	22.77

SCRAP—The prices following are f.o.b. per net ton paid by dealers:

	New York*	Chicago	Birmingham
No. 1 railroad wrought	*$11.75*	**$11.50@$12.00**	$12.00@$13.00
Stove plate	*9.75*	**14.00@ 14.50**	14.00@ 14.50
No. 1 machinery cast	.....	**16.25@ 16.75**	17.00@ 17.50
Machine shop turnings	9.25	**7.00@ 7.50**	8.00@ 8.50
Cast borings	*11.00*	**9.00@ 9.50**	8.00@ 9.00
Railroad malleable	16.25	**15.25@ 15.75**	16.00@ 17.00
Re-rolling rails	*12.00*	**14.00@ 14.50**	15.00@ 16.00
Re-laying rails	23.50	.....	21.00@ 22.00
Heavy melting steel	*10.75*	**11.50@ 12.00**	13.00@ 14.00

*Gross ton.

Railway Supplies

STEEL RAILS—The following quotations are per ton f.o.b. for carload or larger lots. For less than carload lots 5c. per 100 lb. is charged extra:

	Pittsburgh				
	July 1	One Year Ago	Birmingham	Chicago	St. Louis
Standard bessemer rails	$43.00	$43.00	$43.00	$43.00	.....
Standard openhearth rails	43.00	43.00	43.00	43.00	$51.00
Light rails, 8 to 10 lb.	.....	34@36	34@36	1.80@1.90*	2.05*
Light rails, 12 to 14 lb.	34@36	34@36	34@36	1.80@1.90*	1.88*
Light rails, 25 to 45 lb.	34@36	34.00	34@36	1.80@1.90*	1.84*
Re-rolled rails	*28@30*	.....	.....	34@36	18.00

*Per 100 lb.

RAILWAY TIES—For fair-sized orders, the following prices per tie hold:

	6 In. x 8 In. by 8 Ft.	7 In. x 9 In. by 8½ Ft.
Chicago, white oak, plain	$1.35	$1.65
Chicago, empty cell creosoted	1.70	2.00
Chicago, zinc treated	1.50	1.80
San Francisco, green Douglas fir	.84	1.14
San Francisco, empty cell creosoted, Douglas fir	1.70	2.25
St. Louis, white oak, plain	*1.20*	1.50
St. Louis, zinc treated	*1.60*	1.90
St. Louis, red oak, plain	*1.10*	1.40
St. Louis, sap pine-cypress	.95	1.25
Birmingham, white oak	1.25	1.45

TRACK SUPPLIES—The following prices are base per 100 lb. f.o.b. Pittsburgh mill for carload lots, together with the warehouse prices at the places named:

	Pittsburgh					
	July 1	One Year Ago	Chicago	St. Louis	San Francisco	Birmingham
Standard spikes, ⅝-in. and larger	**$2.90@3.00**	$2.80	$3.55	$3.65	$4.35	$3.00
Track bolts	3.90@4.15	3.90@4.00	4.55	4.40	5.85	3.90
Standard section angle bars	2.75	2.75	3.40	3.25@3.75	4.00	4.15

Pipe

WROUGHT PIPE—The following discounts are to jobbers for carload lots at Pittsburgh mill:

BUTT WELD

Inches	Steel Black	Steel Galv.	Inches	Iron Black	Iron Galv.
1 to 3	62	50½	1 to 1½	30	12

LAP WELD

2	55	43½	2	23	7
2½ to 6	59	47½	2½	26	11
7 and 8	56	43½	3 to 6	28	13
9 and 10	54	41½	7 to 12	26	11
11 and 12	53	40½			

BUTT WELD, EXTRA STRONG, PLAIN ENDS

1 to 1½	60	49½	1 to 1½	30	14
2 to 3	61	50½			

LAP WELD, EXTRA STRONG, PLAIN ENDS

2	53	42½	2	23	9
2½ to 4	57	46½	2½ to 4	29	15
4½ to 6	56	45½	4½ to 6	28	14
7 and 8	52	39½	7 and 8	21	7
9 and 10	45	32½	9 to 12	16	2
11 and 12	44	31½			

STEEL PIPE—From warehouses at the places named the following discounts hold for welded steel pipe:

	Black			
	New York	Chicago	Birmingham	St. Louis
1 to 3 in. butt welded	53%	58%	62%	49%
2½ to 6 in. lap welded	48%	55%	59%	46%

	Galvanized			
	New York	Chicago	Birmingham	St. Louis
1 to 3 in. butt welded	39%	45%	50½%	36%
2½ to 6 in. lap welded	35%	42%	47½%	33%

Malleable fittings, Classes B and C, banded, from New York stock sell at list plus 4% less 5%. Cast iron, standard sizes, 36—5% off.

CAST-IRON PIPE—The following are prices per net ton for carload lots:

			New York	
	Birmingham	Burlington, N. J.	July 1	One Year Ago
4 in.	$45.00@46.00	$53.00@55.00	$55.60@57.60	$54.60@55.60
6 in. and over	41.00@42.00	49.00@51.00	51.60@53.60	50.60@51.60

	Pittsburgh	Chicago	St. Louis	San Francisco
4 in.	$53.20@**53.70**	$53.20@54.20	$51.50	*$54.00*
6 in. and over	49.20@**49.70**	49.20@50.20	47.50	*50.00*

Gas pipe and Class "A," $4 per ton extra.

CLAY DRAIN TILE—The following prices are per 1,000 lin.ft.:

	New York					
Size, In.	July 1	One Year Ago	St. Louis	Birmingham	San Francisco	Dallas
3	$45.00	$48.00	$40.00	$45.00	.....	$73.00
4	55.00	50.00	40.00	56.00	$76.50	110.00
5	.....	.....	.....	80.00	97.75	118.00
6	90.00	92.00	70.00	100.00	127.50	150.00
8	160.00	160.00	170.00	165.00	212.50	210.00

SEWER PIPE—The following prices are in cents per foot for standard pipe in car load lots, f.o.b., except as otherwise stated:

Size, In.	New York Delivered	Pittsburgh	Birmingham	St. Louis	Chicago	San Francisco	Dallas
3	.....	*$0.088*	$0.10	.....	$0.09	$0.12	.....
4	.....	*.088*	.10	$0.10	.09	.15	$0.15
5	.....	*.121*	.135	.....	.13½	.18	.18
6	$0.21	*.121*	.21	.14	.13½	.21	.21
8	.35	*.198*	.315	.225	.21	.30	.325
10	.52	*.231*	.45	.315	.31½	.42	.476
12	.66	*.297*	.54	.405†	.40½	.56	.612
15	1.14†	*.396*	.75	.675†	.54	.92	1.02
18	1.65†	*.55*	.90	.945†	.75	1.32	1.53
20	1.98†	*.66*	1.20	.....	.90	.....	.....
21	.....	*.77*	.....	1.26†	.....	.....	.....
22	2.65†	*.88*	1.35	.....	1.20	.....	1.564
24	2.97†	*.99*	2.665	1.62†	1.35	2.16	2.04
27	4.65†	*2.405*	2.952	2.45†	2.75	3.00	3.34
30	5.16†	*2.66‡*	3.96	3.00†	3.75	3.60	4.06
33	6.98†	*3.60*	4.51	3.55†	4.50	.....	4.99
36	8.00†	*4.10*	5.06	3.95†	5.00	.....	5.42

	3	5	8	12	24	36
Boston	*$0.125*	*$0.19*	$0.28	$0.58	$2.00†	$5.50†
Minneapolis	.....	.....	.25	.45	1.50	4.56
Denver	.135*	.18*	.27	.47	1.70	.....
Seattle	.14	.....	.35	.72†	2.60†	.....
Los Angeles	.1625	.195	.275	.495	1.65	.....
New Orleans	.116*	.277*	.295	.463	1.785	.....
Cincinnati	.105	.1575	.245	.4725	1.575	4.715
Atlanta	.10*	.15*	.25	.425	1.625	.....
Montreal	.68‡	.45†	.70	1.35	4.50†	.....
Detroit	.105	.1575	.245	.4725	2.16†	5.6375†
Baltimore	.111	.166	.259	.499	1.665	4.92
Kansas City, Mo.	.15*	.21*	.29	.52	1.90†	3.80†
Philadelphia	.11	.16	.26	.42	1.50	3.70

*4-in., 6-in., 9-in., respectively. †Double Strength. ‡3-in. special.

Road and Paving Materials

ROAD OILS—Following are prices per gallon in tank cars, 8,000 gal. minimum f.o.b. place named:

		July 1	One Year Ago
New York, 45% asphalt	(at terminal)	$0.065 @$0.07	$0.065 @$0.07
New York, 65% asphalt	(at terminal)	.0675@ .0725	.0675@.0725
New York, binder	(at terminal)	.07 @ .075	.07 @.075
New York, flux	(at terminal)	.07 @ .075	.07 @.075
New York, liquid asphalt	(at terminal)	.07 @ .075	.07 @.075
St. Louis, 40@50% asphalt		.055	.049
St. Louis, 50@60% asphalt		.0565	.0527
Birmingham, 55% asphalt		.0475	.0475
Dallas, 45% asphalt		.0495	.0495
Dallas, 55% asphalt		.0455	.0455
Dallas, binder		.061	.061
San Francisco, binder, per ton		12.00*	13.50*

* F.o.b. Oleum, Cal. Freight to San Francisco, 80c. per ton.

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ASPHALT—Price per ton in packages (350-lb. bbls. or 425-lb. drums) and in bulk in carload lots, f.o.b. points listed:

	Package	Bulk
New York (*Texas*)	$23.00	$18.50
Boston (*Mexican*)	23.00	18.50
Chicago (*Texas*)	27.00	23.00
San Francisco, *f.o.b. refinery*, Oleum, Cal.	18.00	12.00
Dallas (*Texas*)	27.10	21.10
Seattle, *"D" grade, California, f.o.b. Richmond*	19.50	13.50
Denver (*California*)	24.00	.....
Minneapolis, *f.o.b. Twin Cities (Stanolind)*	27.60	21.60
St. Louis (*Mexican*)	**27.00**	**24.00**
Baltimore (*Mexican*) (*f.o.b. refinery*)	22.50	18.50
Montreal (*Imperial*)	28.00	*20.68*
Atlanta (*Mexican*)	*23.40*	*19.40*
Detroit (*Mexican*)	22.25	18.50
Cincinnati (*Kentucky Rock*)	.....	11.65
Maurer, N. J. (*Bermudez*)	30.00	.....
Maurer, N. J. (*Trinidad*)	23.00	.....
Philadelphia (*Mexican*)	20.00	18.00
Kansas City, Mo. (*Texas*)	27.30	24.30
Los Angeles (*"D" grade, California*)	*18.00	*12.00
Birmingham (*Mexican*)	27.00	21.00
New Orleans (*Mexican*)	20.00	17.00

* F.o.b. El Segundo Refinery. Drums used in New York.

NOTE—Barrels or drums are optional in most cities. About 6 bbls. to the ton, and from 4 to 5 drums; 200 to 300 gal. to the ton.

PAVING STONE—

New York (grade I)	5-in. granite, 30 blocks per sq.yd.	$147.00 per M.
San Francisco	Basalt block 4x7x8	70.00 per M.
Chicago	about 5x8x5 dressed	3.60 per sq.yd
	about 5x8x5 common	3.25 per sq.yd.
Boston	5-in. Granite	135.00 per M.
Atlanta	Granite	2.50 per sq.yd.
Detroit	5-in. Granite	3.00 per sq.yd.
Baltimore	Granite	2.85 per sq.yd.
Montreal	Granite	104.75 per M.
New Orleans	Granite, 4x8x4	2.75 per sq.yd.
Cincinnati	Granite	135.00 per M.
St. Louis	Granite, 4x8x4	1.65 per sq.yd.
Kansas City	Granite	3.15 per sq.yd.
Philadelphia	Granite	3.90@4.25 per sq.yd.
Minneapolis	Sandstone	2.74 per sq.yd.

FLAGGING—

New York	Bronx, 4 ft. wide	$0.24 per sq.ft.
	Manhattan, 4 ft. wide	.24 per sq.ft.
	Queens, 5 ft. wide	.26 per sq.ft.
	6x24-in. cross-walk	1.30 per lin.ft.

CURBING—*New York*: Bluestone per lin.ft., f.o.b. barge New York, 5x16 in., 88c.; *St. Louis*: Class "A" straight, delivered, 5x18 in., $1.00 per lin.ft.; roundings, *$1.50*. *Birmingham*: Limestone, 5x18-in., $1.05 per lin.ft.

WOOD BLOCK PAVING—	Size of Block	Treatment	Per Sq.Yd.
New York	3	16	$2.40
New York	3½	16	2.70
Boston	3½	18	*2.45*
Chicago	4	16	2.25
Chicago	3½	16	2.10
St. Louis	3½	16	2.45
St. Louis	4	16	2.75
Seattle	4	16	Off market
Minneapolis	3½	16	2.40
Atlanta	3½	16	2.00
New Orleans	3	16	2.20
New Orleans	3½	16	2.30
New Orleans	4	16	2.40
Dallas	4	18	3.90
Baltimore	3½	16	None used
Montreal	4	16	4.50
Detroit	3	16	1.94
Detroit	4	16	.....
Cincinnati	3½	16	2.35
Kansas City	4	16	*2.50*
Philadelphia	4	16	None used

Construction Materials

SAND AND GRAVEL—Price for cargo or carload lots to contractor f.o.b., per cu.yd. is as follows:

	Gravel				Sand	
	1½ In.		¾ In.			
	July 1	One Year Ago	July 1	One Year Ago	July 1	One Year Ago
New York (*alongside dock*)	$1.75	$1.75	$1.75	$1.75	$1.00	$1.00
Denver	1.90	1.90	1.90	1.90	1.00	1.00
Chicago	1.60	.....	1.60	.....	1.40	.....
St. Louis	1.45	1.45	1.45	1.45	1.08	1.18
Seattle	1.50	1.50	1.50	1.50	1.50	1.50
Dallas	2.38	2.25	2.38	2.38	2.00	2.00
Minneapolis	1.65*	1.65*	1.65*	1.65*	1.25	1.25
Cincinnati	1.40†	1.40†	1.40†	1.40†	1.35†	1.35†
San Francisco	1.80	2.15	1.80	2.15	1.40	1.50
Boston	1.50†	1.50†	1.50†	1.50†	1.00†	1.00†
New Orleans	3.00	2.60	3.00	2.60	1.80	1.75
Los Angeles	1.15†	1.30†	1.15†	1.30†	1.10†	1.10†
Atlanta	1.90†	1.90†	1.90†	1.90†	1.50†	1.40†
Detroit	1.45†	2.02	1.35†	2.02	1.10†	1.62
Baltimore	1.40	1.40	1.60	1.60	.70*†	.70*†
Montreal	1.25†	1.25†	1.50†	1.25†	1.25†	1.25†
Birmingham	2.00	2.00	2.00	2.00	1.50	1.45†
Philadelphia	2.10	2.10	2.10	2.10	1.50	1.50
Kansas City	4.00‡	4.00‡	4.00‡	4.00‡	.66*†	.66*†

New York—Grits, $1.75 per cu.yd.; ready mixed $1.85.
* At pit † Per ton. ‡ Joplin chats.

CRUSHED STONE—Price for cargo or carload lots, per cu.yd. f.o.b. city, is as follows:

	1½ In.		¾ In.	
	July 1	One Year Ago	July 1	One Year Ago
New York	$1.75	$1.75	$1.85	$1.85
Chicago	*1.70*	.....	1.87½	.....
St. Louis	1.83*	1.83*	1.93*	1.83*
Dallas	2.40	2.40	2.83	2.83
San Francisco	*1.70*	2.15	*1.70*	2.15
Boston	1.60*	1.60*	1.60*	1.60*
Minneapolis	1.75	1.75	1.75	1.75
Kansas City	2.00	1.50	2.00	1.50
Denver	2.50	2.50	2.50	2.50
Seattle	3.00	3.00	3.00	3.00
Atlanta	2.50*	2.00*	2.50*	2.00*
Cincinnati	1.90*	1.90*	1.90*	1.90*
Los Angeles	1.40*	1.50*	1.40*	1.50*
Detroit	2.00*	1.90	2.00*	1.90
Baltimore	2.50	2.50	2.55	2.55
Montreal	1.80*	1.80*	1.70*	1.90*
Philadelphia	2.10	2.10	2.10	2.10
Pittsburgh	2.85	2.85	2.85	2.85
Cleveland	2.70*	3.25*	2.70*	3.25*
Birmingham	2.00	2.00	2.00	2.00

* Per ton.

CRUSHED SLAG—Price of crushed slag in carload lots, per net ton, at plant

	1½-In	¾-In.	Roofing	Sand
Youngstown District	$1.30	$1.40	$2.00	$1.30
Steubenville District	1.25	1.30	2.00	1.30
Ironton District	1.40	1.40	2.00	1.40
Birmingham, Ala	.80@.90	1.15	2.05	.....
Cleveland, Ohio	1.80	1.80	.....	1.75
Eastern Pa. and Northern N. J.	1.25	1.25	2.50	1.25
Western Pennsylvania	1.25	1.25	2.00	1.25
Toledo, Ohio	1.25	1.25	1.50	1.25

LIME—Warehouse prices:

	Hydrated, per Ton		Lump, per Barrel	
	Finishing	Common	Finishing	Common
New York	$18.20	$12.10	$3.50*	$2.10@3.00*
Chicago	20.00	18.00	.....	2.25*
St. Louis	23.50	19.50	.....	2.03*
Boston	19.50	12.50@13.50	3.70*	2.95*
Dallas	18.00	.....	.....	1.85†
Cincinnati	16.80	14.30	.....	13.40‡
San Francisco	.....	22.00	.....	1.60†
Minneapolis	25.50	21.00	.....	1.60@1.70†
Denver	24.00	.....	.....	2.70*
Detroit	18.50	15.00	.....	18.50‡
Seattle, *paper sacks*	24.00	.....	2.80†	.....
Los Angeles	25.00	18.00	3.50*	19.50‡
Baltimore	24.25	17.85	2.55†	.....
Montreal	.....	21.00	.....	10.00‡
Atlanta	23.50	13.00	2.20†	1.50†
New Orleans	24.00	15.00	2.50†	2.00*
Philadelphia	23.00	16.00	.....	.....
Kansas City	17.50	15.00	2.59†	2.24*
Birmingham	22.50	16.00	2.40†	1.85†

* Per 280-lb. bbl. (net). † Per 180-lb. (net). ‡ Per ton.

NATURAL CEMENT—Price to dealers per bbl. for 500 bbl. or over, exclusive of bags:

	July 1	One Year Ago
Minneapolis (Rosendale)	$2.80	$2.80
Kansas City (Ft. Scott)	1.50	1.35
Cincinnati (Utica)	1.72	1.72
Boston (Rosendale)	2.60	2.50
St. Louis (Carney)	2.35	2.30
Birmingham (Magnolia) pozzolan cement	2.40	2.40

PORTLAND CEMENT—Prices to contractors per bbl. in carload lots f.o.b. points listed *without bags*. Cash discount not deducted.

	July 1	One Month Ago	One Year Ago
New York, del. by truck	$2.50@$2.60	$2.50@$2.60	$2.50@$2.60
New York, alongside dock to dealers	2.15	2.15	2.15
Jersey City	2.33	2.33	2.33
Boston	2.35	2.35	2.50
Chicago	2.10	2.10	2.20
Pittsburgh	2.09	2.09	2.19
Cleveland	2.29	2.29	2.39
Detroit	2.15	2.15	2.35
Indianapolis	2.29	2.29	2.41
Milwaukee	2.25	2.25	2.35
Duluth	2.09	2.09	2.19
Peoria	2.27	2.27	2.37
Cedar Rapids	2.34	2.34	2.44
Davenport	2.29	2.29	2.39
St. Louis	2.20	2.20	2.30
San Francisco	2.31	2.31	2.31
New Orleans	2.30	2.30	2.40
Minneapolis	2.32	2.32	2.42
Denver	2.85	2.85	2.84
Seattle	2.65	2.65	2.65
Dallas	2.05	2.05	2.05
Atlanta	2.35	2.25	2.40
Cincinnati	2.37	2.37	2.47
Los Angeles	*2.30*	2.36	2.52
Baltimore	2.35	2.35	2.50
Birmingham	2.40	2.40	2.40
Kansas City, Mo	2.35	2.35	2.20
Montreal	*1.15*	1.42	1.80
Philadelphia	2.41	2.41	2.41
St. Paul	2.32	2.32	2.42
Toledo	2.20	2.20	2.40

NOTE—Bags 10c. each, 40c. per bbl.; 20c. each in Canada, 80c. per bbl.

Current mill-prices per barrel in carload lots, without bags, to contractors:

Buffington, Ind	$1.85	Hudson, N. Y	$2.05
Universal, Pa	1.85	Leeds, Ala	1.95
Steelton, Minn	1.90	Hannibal, Mo	1.95
Fordwick, Va	2.05	Lehigh Valley District	1.95
Mitchell, Ind	1.95	Wyandotte, Mich	1.90
Iola, Kan	1.85	Alpena, Mich	1.75
Mason City, Ia	1.90	Richard City, Tenn	2.05
La Salle, Ill	1.95	Kingsport, Tenn	2.05

E. N.-R. Prices of Construction Materials

TRIANGLE MESH—Price per 100 sq.ft. in carload lots:

PLAIN 4-INCH BY 4-INCH MESH

Style Number	Weight in Pounds per 100 sq.ft.	Pittsburgh Mill	Chicago District Mill	Warehouse: New York	Warehouse: St. Louis	Warehouse: Dallas	Warehouse: San Francisco
032	22	$0.97	$1.01	$1.39	$1.06	$1.13	$1.22
049	28	1.23	1.29	1.76	1.35	1.38	1 55
068	35	1.51	1.58	2.16	1 66	1.67	1.91
093	45	1.94	2.03	2.77	2.13	2.00	2 46
126	57	2.39	2.51	3.45	2.63	2.55	3.03
153	68	2.86	2 99	4.11	3.14	3.15	.....
180	78	3.28	3 43	5.70	3.60	3.47	.....
245	103	4.33	4.53	6.21	4.75	4.58	.....
287	119	5.00	5.24	7.19	5.50	5.26	6.35
336	138	5.80	6.07	8.35	6.37	6.11	.....
395	160	6.72	7.04	9.65	7.38	7.12	.....
PAVING							
036P	17	$0.74	$0.77	$1.06	$0.81	$0.76	.....
053P	24	1.04	1.09	1.50	1.14	1.07	.....
072P	31	1.32	1.38	1.90	1.45	1 39	.....
097P	40	1.70	1.78	2.45	1.87	1 90	.....
049R	24	1.04	1.09	.....	1.14	1.07	.....
067R	31	1.32	1.38	.....	1.45	1.39	.....
089R	40	1.70	1.78	.....	1.87	1.90	.....

In rolls, 48-, 52-, and 56-in. wide and in 150-, 200- and 300-ft. lengths. Galvanized is about 15% higher. Size of roll carried in New York warehouses, 48 in. wide x 150 ft. long, or 600 sq.ft.

EXPANDED METAL LATH—Prices in carload lots per 100 yd. for painted:

Weight in pounds	New York	Birmingham	Chicago	St. Louis	San Francisco	Dallas
2.2	$17.00	$19.50	$17.50	$17.00	$19.00	$23.50
2.5	18.50	21.50	19.00	18.50	21.00	25.00
3.0	21.50	24.50	22.00	21.50	24.50	28.50
3.4	23.50	27.50	24.00	23.50	27.00	31.00

BARS, CONCRETE REINFORCING—Current quotations per 100 lb.:

ROLLED FROM BILLETS

Inches	Pittsburgh Mill	Birmingham	Warehouse, Uncut: New York	Chicago	St. Louis	Dallas	San Francisco
½ and larger	$1.90@2.00	$2.25	$3.24	$3.00	$3.15	$3.38	*2.95*
⅝	2.00@2.10	2.35	3.34	3.10	3.25	3.43	*3.05*
¾	2.10@2.20	2.45	3.44	3.20	3.35	3.48	*3.15*
⅞	2.30@2.40	2.65	3.64	3.40	3.55	3.63	*3.35*
1	2.90@3.00	3.25	4.24	4.00	4.15	3.78	*3.95*

For standard classification of extras for size and cutting of steel bars, see bar card of July 15, 1923.

ROLLED FROM RAILS

	St. Louis	Dallas		St. Louis	Dallas
½ and larger	$2.35	$2.80	½	$2 75	$3.02
⅝ in.	2 45	2.85	¼	3.35	3.20
¾	2.55	2.90	.....	.....	.....

BRICK—Contractors price per 1,000 in cargo or carload lots is as follows:

	Common: July 1	Common: One Month Ago	Common: One Year Ago	Paving Block: 3-inch*	Paving Block: 3½-inch*
New York (del.)	$20 40	$20.40	$19 @ 20	$45.00	$51.00
New York (at dock)	17.00	17.00	16@17	.....	.....
Chicago	12.00	12.00	12.00	42.00	45.00
St. Louis, salmon (del.)	16.00	16.00	16.00	40.00	42.50
Denver, salmon	12.00	12.00	12.00	.....	.....
Dallas	14.10	14.10	12.10	35.00	.....
San Francisco	15.00	15.00	15.50	.....	.....
Los Angeles	*9.00*	11.50	12.00	(not used)	
Boston (del.)	18.50	18.50	17 50	45.00	50.00
Minneapolis (del.)	*13.75*	14.25	13.50	.....	.....
Kansas City	15.00	15.00	14.50	(no market)	
Seattle	15.00	15.00	15.00	.....	42.50
Cincinnati	17.00	17.00	17.00	40.00	45.00
Montreal	17.50	17.50	17.50	100.00†	68.00
Detroit (del.)	16.00	16.00	16.00	38.40	41.50
Baltimore	18.00	18.00	18.00	40.00	45.00
Atlanta	10.50	10.50	10.50	40.00	.....
New Orleans	15.00	15.00	15.00	.....	50.00
Birmingham	12.50	12.50	12.50	40.00	45.00
Philadelphia	*17@19*	18@19	19.00	40.00	50.00
Pittsburgh (del.)	16.00	16.00	16.00	.....	.....
Cleveland	16 00	14 00	14.00	.....	.....

*For paving blocks 3x8½x4 and 3½x8½x4 respectively. †Imported.

HOLLOW TILE—Price per block in carload lots to contractor for hollow building tile.

	New York: July 1 on Trucks*†	New York: One Year Ago	Chicago	Philadelphia	St. Louis	San Francisco†	Perth Amboy N. J., Factory*
4x12x12	$0.1112	$0.1162	$0.075	$0.12	$0.07	$0.108	.....
6x12x12	.1667	.1743	.096	.....	.094	.156	.....
8x12x12	.2084	.2179	.135	.22	.128	.244	.....
10x12x12	.....	.....	.167	.....	.16	.....	$0.252
12x12x12	.....	.....	.215	.....	.19	.....	.312

*5 per cent off for cash. †Partition tile.

	4x12x12	8x12x12	12x12x12
Boston	$0.085	$0.175	.....
Minneapolis (f.o.b. cars)	.068	.1175	$0.205
Minneapolis (delivered)	.076	.13	.225
Cincinnati	.07485	.13745	.....
Kansas City	.088	.158	.242
Denver	.075	.155	.188
Seattle (delivered)	.09	.18	.26
Los Angeles	.085	.172	.....
New Orleans	.13	.20	.35
Detroit (delivered)	.1095	.2821	.....
Montreal	.12	....	.....
Baltimore	.125	.27	.....
Atlanta	.0895	.1837	.....
Dallas	.112	.21	.31
Birmingham	.1	.124	.255
Pittsburgh (delivered)	.068	.128	.179
Cleveland	*.062*	.149	.....

STRUCTURAL MATERIAL—Following are base prices f.o.b. mill, Pittsburgh and Birmingham, together with quotations per 100 lb. from warehouses at places named:

	Pittsburgh Mill	Birmingham	Warehouse: New York	Warehouse: Dallas	Warehouse: St. Louis	Warehouse: Chicago	Warehouse: San Francisco
Beams, 3 to 15 in.	$1.90@2.00	$2.05	$3.34	$4.15	$3.25	$3.10	$3.30
Channels, 3 to 15 in.	1.90@2.00	2.10	3.34	4.15	3.25	3.10	3.30
Angles, 3 to 16 in., ¼ in. thick	1.90@2.00	2.10	3.34	4.15	3.25	3.10	3.30
Tees, 3 in. and larger	1.90@2.00	2.10	3.34	4.15	3.35	3.10	3.30
Plates, ¼ in. thick and heavier	1.85@1.90	2.00	3.34	4.15	3.25	3.10	3.30

RIVETS—The following quotations are per 100 lb.:

STRUCTURAL

	Pittsburgh Mill	Warehouse: New York, July 1	Warehouse: New York, One Yr. Ago	Warehouse: Chicago	Warehouse: St. Louis	Warehouse: San Francisco	Warehouse: Dallas
½ in.	$2.50@2.60	$4.50	$4.50	$3.50	$3.65	$5.00	$4.75
CONE HEAD BOILER							
½ in.	2.90	$4 70	$4.70	$3.70	$3.85	$5 20	$5.00
⅝ and ¾	3.05	4.85	4.85	3.80	4.20@4.45	5.35	5.15
⅞ and 1	3 30	5.10	5.10	4.05	4.60	5.60	5.50

NAILS—The following quotations are per keg from warehouse:

	Pittsburgh Mill	Birmingham	Chicago	San Francisco	Dallas	St. Louis	Montreal
Wire	$2 65	$2.85	$3.05	$3.75	*$4.25*	$2.93	$4.95
Cut	2.80	2.90	.....	5.00	5.00	3.15	5.00

SHIP SPIKES—Current prices per 100 lb.:

In.	San Francisco: Galv.	San Francisco: Black	Seattle Black
½	$7.50	$5.75	$7.75
⅝	7.05	5.30	5.65
¾	6.90	5.15	5.50

Pittsburgh base in lots of 200 kegs or more, $3.25.

PREPARED ROOFINGS—Slate-surfaced roofing in rolls of 108 sq.ft. costs $2.35@$2.50 per roll to contractors in carload lots f.o.b. New York.

Single shingles, slate finish, cost $7.00 per square (sufficient to cover 100 sq.ft.) in carload lots, f.o.b. New York. Strip shingles (4 in 1) f.o.b. New York, in carload lots to contractors, $5.00 per square.

ROOFING MATERIALS—Prices f.o.b New York, to contractors in carload lots:

Tar felt (14 lb. per square of 100 sq.ft.) per ton	$70.00
Asphalt roofing (in barrels) per ton	25.00
Asphalt felt, per ton	72.00

WINDOW GLASS—United inches, 25, bracket size 6x8 to 10x15, single thickness "AA," 83 per cent; "A," 87 per cent; "B," 89 per cent. Double thickness "AA," 82 per cent; "A," 86 per cent; "B," 89 per cent discount from jobbers list at New York warehouses.

SHEETS—Quotations are per 100 lb. in various cities from warehouse also the base quotations from mill:

Blue Annealed	Pittsburgh Large Mill Lots	St. Louis	Chicago	San Francisco	New York
No. 10	*2.30@* 2.40	$3.60	$3.50	$3.90	$3.89
No. 12	*2.35@* 2.45	3.65	3.55	3.95	3.94
No. 14	*2.40@* 2.50	3.70	3.60	4.00	3.99
No. 16	*2.50@* 2.60	3.80	3.70	4.10	4.09
Black					
*Nos. 18 to 20	2.95@ 3.05	4.40	3.90	*4.70*	4.30
*Nos. 22 to 24	3.00@ 3.10	4.45	3.95	*4.75*	4.35
*Nos. 26 and 27	3.05@ 3.15	4.50	4.00	*4.80*	4.40
*No. 28	3.15@ 3.25	4.60	4.10	*4.90*	4.50
Galvanized					
No. 10	*3.25@*3.40	4.70	4.25	5.00	4.65
Nos. 12 to 14	*3.35@*3.50	4.80	4.35	5.10	4.75
No. 16	*3.50@*3.65	....	4.50	5.25	4.90
Nos. 18 to 20	*3.65@*3 80	5.10	4.65	5.40	5.05
Nos. 22 to 24	*3.80@*3.95	5.25	4.80	5.55	5.20
*Nos. 26 and 27	*3.95@*4.10	5.40	4.95	5.70	5.35
*No. 28	*4.25@*4 40	5.70	5.25	6.00	5.65

* For painted corrugated sheets add 30c. per 1,000 lb. for 5 to 28 gage; 25c. for 19 to 24 gages; for galvanized corrugated sheets add 15c., all gages.

LINSEED OIL—These prices are per gallon:

	New York: July 1	New York: One Year Ago	Chicago: July 1	Chicago: One Year Ago
Raw in barrels (5 bbl. lots)	$0.89½	$1.07	$0.84	$1.23

E. N.-R. Prices of Construction Materials

WHITE AND RED LEAD—Per 100-lb. keg, base price, f.o.b. New York:

	Dry		In Oil	
	July 1	1 Yr. Ago	July 1	1 Yr. Ago
Red	$15.25	$15.75	$16.75	$17.25
White	15.25	15.75	15.25	15.75

Lumber

Prices wholesale, per M. ft. b.m., to dealers in carload lots, f.o.b.

San Francisco—Prices of rough Douglas fir No. 1 common, in carload lots to contractors at yards.

	6-8 and 12 Ft.	10-16-18 and 20 Ft.	22 and 24 Ft.	25 to 32 Ft.
3x3 and 4	$26.00	$27.00	$28.00	$31.00
3x6 and 8	26.00	27.00	28.00	31.00
4x4-6 and 8	26.00	27.00	28.00	31.00
3x10 and 12	26.00	27.00	28.00	31.00
3x14	30.00	30.00	32.00	34.00
4x10 and 12	26.00	27.00	28.00	31.00
4x14	30.00	30.00	32.00	34.00

	24 Ft. and Under	25 to 32 Ft.	33 to 40 Ft.
6x10	$28.00	$30.00	$32.00
6x14	34.00	36.00	38.00
8x10	28.00	30.00	32.00
8x14	34.00	36.00	38.00

New York and Chicago—Wholesale prices to dealers of long leaf yellow pine.

	New York		Chicago	
	20 Ft. and Under L.L.Y.P.	22-24 Ft. L.L.Y.P.	20 Ft. and Under No. 1 L.L.Y.P.	Up to 32 Ft. No. 1 Douglas Fir
3x4 to 8x8	$43.00	$44.00	*$41.50*	*$40.50*
3x10 to 10x10	50.00	51.00	47.50	*40.50*
3x12 to 12x12	57.00	58.00	57.50	*40.50*
3x14 to 14x14	65.00	66.00	.....	*40.50*
3x16 to 16x16	77.00	78.00	.....	42.00

New York—Wholesale price of long-leaf pine to dealers; to contractors, delivered from lighters or cars to job, $5@$10 additional. Short-leaf pine costs $3 per M. ft. less.

Over 24 ft.—Add $1 for each additional 2 ft. in length up to 32 ft. and $1 for each additional foot from 32 to 36 ft.

Other Cities

	8x8-In. x 20 Ft. and Under				12x12-In. 20 Ft. and Under	
	P.	Fir*	Hemlock	Spruce	P.	Fir*
Boston	*$50.00*	$48.50†	*$50.00*	$50.50	$60.00	$58.00†
Seattle	.....	24.00	.....	.....	.....	*23.00*
New Orleans	35.00	.....	.....	.....	43.00	.....
Baltimore	32.50	49.25	53.00	60.00	38.00	49.75
Cincinnati	37.00	73.00	73.00	85.00	48.00	77.00
Montreal	50.00	58.00	.....	.....	60.00	65.00
Los Angeles	.....	36.64	.....	.....	.....	36.64
Denver	.....	**36.25**	34.75	34.75	.....	34.75
Minneapolis	*41.00*	*38.25*	*34.00*	.....	*43.00*	*38.75‖*
Atlanta	31.00	.....	.....	.....	34.00	.....
Dallas	56.00	.....	.....	.....	56.00	.....
Kansas City, Mo.	44.50	40.75	.....	.....	59.50	41.75
Birmingham	32.00	.....	.....	.....	34.00	.....
Philadelphia	54.00	36.00	38.00	45.00	65.00	36.00
Detroit	47.75	46.75	.....	.....	61.75	46.75
St. Louis	41.00	.....	.....	.....	53.00	.....

	1-In. Rough, 10 In. x 16 Ft. and Under			2-In. T. and Gr. 10 In. x 16 Ft.	
	P.	Fir*	Hemlock	P.	Fir*
Boston	$46.00	$42.50†	$45.00	$50.00	$48.00†
Seattle	.....	**22.00**	.....	.....	24.00
New Orleans	72.50	.....	.....	45.00	.....
Baltimore	55.00	44.00	44.00	34.00	50.00
Cincinnati	70.00	79.00	75.00	38.00	85.00
Montreal	45.00	50.00	40.00	65.00	50.00
Los Angeles	.....	35.64	.....	.....	.....
Denver	.....	**33.25**	33.25	.....	*32.25*
Minneapolis	42.50	*36.25*	34.75	*35.00*	34.25
Atlanta	22.00	.....	.....	28.00	.....
Dallas	52.00	.....	.....	56.00	.....
Kansas City, Mo.	54.25	40.75	.....	42.25	36.75
Birmingham	27.00	.....	.....	42.00	.....
Philadelphia	32.00	36.00	36.00	52.00	35.00
Detroit	39.75	37.00	.....	46.50	41.25
St. Louis	42.00	.....	.....	29.50	.....

Birmingham—Quotes carload lots, f.o.b. sidings; $4.00 additional per M. ft. to contractors.
Boston and Cincinnati—Prices to contractors in carload lots, f.o.b.
Denver—Quotes dealers price to contractors on large projects.
St. Louis—Wholesale price to contractors, f.o.b. cars, $2 per M.ft. additional.
Seattle—Price to contractors, delivered.
Dallas—Wholesale to contractors, $10 per M.ft. additional.
*Douglas fir. †Prime.

PILES—Prices per lineal foot, pine piles with bark on, f.o.b. New York.

Diameters	Points	Length	Barge	Rail
12 in. at butt	6 in.	50 to 59 ft.	$0.14½	$0.18½
12 in.—2 ft. from butt	6 in.	50 to 59 ft.	.19	.23½
12 in.—2 ft. from butt	6 in.	60 to 69 ft.	.21½	.25½
14 in.—2 ft. from butt	6 in.	50 to 69 ft.	.25½	.34
14 in.—2 ft. from butt	6 in.	70 to 79 ft.	.27½	.36½
14 in.—2 ft. from butt	5 in.	80 to 89 ft.	.35	.41

Miscellaneous

STEEL SHEETPILING—The following price is base per 100 lb. f.o.b. Pittsburgh, with a comparison of a month and a year ago:

July 1	One Month Ago	One Year Ago
$2.25@$2.30	$2.25@$2.30	$2.25@$2.30

CONCRETE MASONRY UNITS—Standard 8x8x16-in., delivered to job, each:

Denver	$0.22	St. Louis	$0.18*
Detroit	.16	Boston	.22
New Orleans	.23	Minneapolis	.18*
New York (Brooklyn)	.18@.20	*Philadelphia	.18@.26
Pittsburgh	.21@.25	*f.o.b.	

WIRE ROPE—Discounts from list price on regular grades of bright and galvanized are as follows:

	Eastern Territory New York and East of Missouri River
Plow steel round strand rope	35%
Special steel round strand rope	30%
Cast steel round strand rope	20%
Round strand iron and iron tiller	5%
Galvanized steel rigging and guy rope	7½%
Galvanized iron rigging and guy rope	+12½%

California, Oregon, Nevada and Washington: Discount 5 points less than discount for Eastern territory.
Wyoming, New Mexico and Colorado: Discount 5 points less than discount for Eastern territory.
Arizona: Discount 10 points less than discount for Eastern territory.
Montana, Idaho and Utah: Discount 10 points less than discount for Eastern territory.
North Dakota, Nebraska, Kansas, Oklahoma and Texas: Discount 5 points less than discount for Eastern territory.

MANILA ROPE—For rope smaller than ¾-in. the price is ½ to 2c. extra; while for quantities amounting to less than 600 ft., there is an extra charge of 1c. The number of feet per pound for the various sizes is as follows: ½-in., 8 ft.; ⅝-in., 6; ¾-in., 4½; 1-in., 3½; 1¼-in., 2 ft. 10 in.; 1½-in., 2 ft. 4 in. Following is price per pound for ¾-in. and larger, in 1200-ft. coils:

Boston	**$0.21**	New Orleans	*$0.23½*
New York	.26	Los Angeles	.25
Chicago	.24½	Seattle	.24
Minneapolis	.26½	St. Louis	.24½
San Francisco	.25	Montreal	.16
Atlanta	.27	Detroit	.24½
Denver	.26@.27	Baltimore	.18
Cincinnati	.21	Kansas City	.28
Dallas	.31	Birmingham	.26@.27
Philadelphia	*.25*		

EXPLOSIVES—Price per pound of dynamite in small lots:

	Gelatin 40%	Gelatin 60%
New York	$0.265*	$0.2875*
Boston	.23	.255
Kansas City	.2025	.22
Seattle	.165	.19
Chicago	.1475†	.17†
Minneapolis	.1917	.2123
St. Louis	.22	.245
Denver	.2025	.2275
Dallas	.225	.302
Los Angeles	.1875	.2225
Atlanta	.215	.24
Baltimore	.22	.23
Cincinnati	.22	.245
Montreal	.195	.235
Birmingham	.22	.24
New Orleans	.233	.26
San Francisco	.1625	.1925
Philadelphia	.215	.24

*Special gelatin. †Quantities above 500 lb.

CHEMICALS—Water and sewage treatment chemicals, spot shipments in carload lots, f.o.b. works:

Sulphate of aluminum, in bags, per 100 lb.	$2.00@$2.10
Sulphate of copper, in bbl., per 100 lb.	4.75@5.00
Soda ash, 58%, in bags, per 100 lb.	1.38@1.55
Chlorine, liquid, tanks, per lb.	.04@.04½
Hypochlorite of lime (bleaching powder) in drums, per 100 lb.	2.00@2.10

FREIGHT RATES—On finished steel products in the Pittsburgh district, including plates, structural shapes, merchant steel, bars, pipe fittings, plain and galvanized wire nails, rivets, spikes, bolts, flat sheets (except planished), chains, etc., the following freight rates are effective in cents per 100 lb., in carloads of 36,000 lb.:

Atlanta	$0.58	Detroit	$0.29
Baltimore	.31	Kansas City	.735
Birmingham	.56	New Orleans	.67
Boston	.365	New York	.34
Buffalo	.265	Pacific Coast (all rail)	1.15*
Chicago	.34	Philadelphia	.32
Cincinnati	.29	St. Louis	.43
Cleveland	.19	St. Paul	.60
Denver	1.15*		

* Minimum carload, 50,000 lb., structural steel only; 80,000 lb., for other iron or steel products.